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The External Anatomy of the Capsidae

THE EXTERNAL ANATOMY OF THE CAPSIDAE

BY

CHARLES STOCKMAN SPOONER

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Charles Stockmar Spooner

ENTITLED The External Anatomy of the Capsidae

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF Master of Arts in Entomology

Alex D. MacGillivray
In Charge of Thesis

Stephen A. Forbes
Head of Department

Recommendation concurred in:*

Committee on Final Examination*

*Required for doctor's degree but not for master's.

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I. INTRODUCTION.

The Family Capsidae is a large and seemingly heterogeneous group. The present classification appears to be very artificial and cumbersome. This study was undertaken in hopes of finding characters upon which to base a more truly phylogenetic grouping. For this purpose a thorough study of the external anatomy has been made.

This group is the largest and most dominant one of the Heteroptera. It is characterized primarily by the four segmented antennae, four segmented rostrum, the absence of ocelli, the presence of a cuneus and usually two, occasionally only one, basal cells in the membrane of the hemelytra. The species are largely plant feeders, a few are recorded as predaceous. The size, form and color of the species are very variable.

No extensive work has been published on the external anatomy of this group. The best and most recent study is that of Reuter, 1912. In this article he devotes considerable space to a discussion of the external characters, especially of those upon which he bases his classification. He mentions briefly the variations found in the form of the head and pronotum, the form and comparative length of the segments of the antennae and legs, the form of the arolia and the wing venation. This is, however, by no means a detailed anatomical study.

It seems appropriate here to mention the importance of the work of Dr. O.M.Reuter in this group. His "Hemiptera Gymnocerata Europae" comprises five volumes with many excellent figures in color. It forms the basis of our present knowledge of the group. He also studied and described a large number of Amer-

ican genera and species.

Heymons, 1899, published the results of an extensive investigation on the embryology of the Hemiptera. He was able to point out many interesting and important relationships of the various sclerites. Many of these relationships could not have been shown except by this type of work.

Bungion and Popoff, 1911, investigated the anatomy of the head and mouthparts of the Hemiptera. The most important facts brought out were upon the mechanics of the hemipterous mouth.

Muir and Kershaw, 1911, discuss the anatomy and embryology of the head of various Hemipterons. Their deductions differ somewhat from those of Heymons. These will be discussed later.

Parshley, 1915, contributed a short paper on the anatomy of the Capsidae. This is a very useful work as it discusses primarily those structures used in the classification of the group and points out, with the aid of excellent figures, the principle lines of divergence and the terms used in defining them.

III. PREPARATIONS.

Specimens of most of these species were prepared by soaking entire insects in three percent potassium hydroxide for varying lengths of time. From two to twelve hours were necessary to soften them, the time depending upon the amount of chitinization of the species. Subjecting them for too long a time to the action of the caustic caused distortion, especially of the thoracic structures. The heads were then removed and further treated in ten percent potassium hydroxide for twenty-four hours. At the end of that time the mass of muscle could be readily removed through the occipital foramen. The resulting preparations were clear semi-transparent skeletons. The studies were made in alcohol with a binocular microscope.

The wings were mounted on slides in glycerine jelly and photographed.

In the case of a few of the more uncommon species, only one specimen of each was available. For this reason, studies could be made only from the dried specimens. These studies were, therefore, less extensive than those made from the treated material.

II. MATERIALS.

Studies were made of the following twenty-five species representing eleven tribes:

Tribe Phylini

Chlamydatus associatus (Uhl.)

Reuteroscopus ornatus (Reut.)

Tribe Orthotylini

Pseudoxenetus scutellatus (Uhl.)

Lopidea media (Say)

Pilophorus schwarzi Reut.

Strongylocoris stygicus (Say)

Tribe Diciphini

Hyaliodes vitripennis (Say)

Tribe Hallodapini

Coquilletia amoenus (Uhl.) From the Bolter Collection, Museum of the University of Illinois.

Tribe Fulvini

Fulvius brunneus (Prov.) From the Collections of the State Laboratory of Natural History, through Mr. C. A. Hart.

Tribe Cylapini

Cylapus tenuicornis Say

Tribe Clivinemini

Clivinema villosa Reut. From the Bolter Collection, Museum of the University of Illinois.

Tribe Bryocorini

Monolocoris filicis (Linn.)

Sixeonotus tenebrosus Dist.

Tribe Capsini

Camptobrochis nebulosus (Uhl.)

Cimatlan mundum (Uhl.)

Lygus pratensis (Linn.)

Lygus species

Poecilocapsus lineatus (Fabr.)

Poeciloscytus venaticus Uhl. (?)

Garganus fusiformis (Say)

Adelphocoris rapidus (Say)

Neurocolpus nubilis (Say)

Tribe Horistini

Platytylellus species

Tribe Mirini

Trigonotylus ruficornis(Fall)

Miris dolobrata (Linn.)

IV. ACKNOWLEDGEMENTS.

The writer wishes to express his appreciation of the constant aid and inspiration received from Professor A.D.MacGillivray, under whose direction this work was done. He kindly permitted his very extensive manuscript on the comparative anatomy of insects to be freely consulted and generously allowed the use of some of the terms which he has there proposed. Indeed, without the use of this work, this thesis could not have assumed its present form. Because this discussion is based upon ideas and terms derived from the unpublished manuscript of another worker, the author must reserve all rights of publication and quotation until the aforesaid manuscript shall have been published.

Further, the writer wishes to thank Professor S.A.Forbes for courtesies shown and Doctor Edna Mosher for aid and suggestions. Mr. C.A.Hart, of the Illinois State Laboratory of Natural History, kindly aided in the determination of several of the species discussed.

V. THE FIXED PARTS OF THE HEAD.

The head in the Capsidae is very different in general form from that of most other Hemiptera. Chlamydatus associatus (Figs. 3 and 28) has been chosen as exemplifying the generalized or typical capsid head. Its three dimensions are nearly equal. The mouth opening is ventral.

Typical Head.- The epicranial suture is always wanting in the adult. It is plainly evident (Figs. 1 and 2) in most nymphs, however, where it extends cephalad from the occipital foramen to a point nearly in line with the caudal margins of the compound eyes. At this point it divides and an epicranial arm extends cephalo-laterad on each side to the cephalo-measl angles of the compound eyes. In some nymphs the arms fade out about half way between the meson and the compound eyse. The area caudad of the epicranial arms is the vertex, In the adult the vertex is limited to the area on the dorsal aspect caudad of a line drawn between the caudal margins of the compound eyes and a small triangle extending cephalad along each mesal margin.

Across the dorsal aspect of the vertex, slightly caudad of the dorso-caudal angles of the compound eyes, there is a slight ridge or carina. This ridge marks the extent of the retraction of the caudal margin of the head within the anterior foramen of the prothorax.

The front comprises the remainder of the dorsal aspect, curves abruptly and extends to the middle of the cephalic aspect. There is no transverse suture separating the front from the remaining cephalic sclerites. There is,on each side of the meson near the middle of the cephalic aspect, a deep furrow which extends

ventrad to the ventral margin of the head, a clypeal furrow. These enclose a quadrangular area, free from the structures on either side, the clypeus. This sclerite protrudes cephalad beyond the remainder of the head. When viewed from the side it appears as a prominent, hooked nose.

Attached to the ventral margin of the clypeus is an elongate triangular sclerite, the labrum. It is movably united to the clypeus by a narrow area of membrane. Lining the ventral surface of the labrum is the epihparynx. Normally the labrum rests upon the dorsal surface of the first segment of the rostrum, furnishing a cover to the groove containing the maxillary and mandibular setae. It thus supports and strengthens these structures when in use. The suture which originates just ventrad of the middle of each clypeal furrow is a mandibular suture. These sutures extend laterad for a short distance, curve gradually dorso-laterad, ending near the ventro-measl angles of the antennal fossae. At the dorso-lateral ends of these sutures are located the invaginations, the ental ends of which serve as points of articulation for the mandibles. There is, on each side of the head, a furrow starting dorsad of the antennal fossa, extending latero-ventrad, passing through the point of invagination of the mandibular articulation, thence curving slightly mesad and continuing to the ventral margin of the head. These may be known as the genal furrows.

The areas dorsad of the mandibular sutures are known as the jugae. The homology of these structures is still a debated question. Heymons, 1899, states that they are partially formed from the lateral portions of the mandibular buds together with portions of the antennal segments. His own figures show no in-

dication of this and as Muir and Kershaw, 1911, give no such interpretation, the writer does not feel justified in following Heymons. Muir and Kershaw consider the invaginations for the attachment of the mandibles homologous with the mandibular attachments of insects with biting mouth-parts and that, therefore, the area ventrad of these invaginations must be the clypeus and that the jugae are projections of the clypeus. The sclerite designated by them as the clypeus is the front, their labrum is the clypeus and their epipharynx is the labrum. MaGillivray, MSS, considers that these invaginated mandibular attachments are not at all homologous with the mandibular attachments in biting insects, but that they are entirely new structures resulting from the withdrawal of the mandibles within the head. They are not, therefore, considered as marking the cephalic margin of the clypeus. The jugae, therefore, are projections of the front. The writer beleives that the evidence available upholds this interpretation. Further embryological work is needed to definitely settle the question.

While the jugae are not distinct sclerites but merely areas of the front, they have been much used in systematic descriptions and it will be most convenient to retain this term for their designation.

The areas ventrad of the mandibular sutures are the hemimaxillae. Their latteral extent is not defined by a suture. The genal furrow may possibly indicate a limit to their extent although there is no evidence to prove this. It seems more probable that the genal furrow is connected with the invagination of the mandibular attachment.

The term gena has been applied to the portion of the hemimaxilla ventrad of the antennal fossa and the compound eye. The term is here considered as an area of the head and not as a distinct sclerite.

The ventral margin of each hemimaxilla has been deflected slightly laterad. The line of bending is marked by a rather well defined furrow. This is not a suture. These bent edges are termed the bucculae. This is merely a term of convenience as they are an integral part of the hemimaxillae. The bucculae serve as places of attachment for the membrane uniting the first segment of the rostrum with the head and for lateral supports for this organ.

The caudal margin of each hemimaxilla fuses with a postgena without indication of a suture. The suture marking the union of a postgena with the vertx is also wanting. The postgenae curve mesad at the ventral margin of the lateral aspect and fuse on the meson of the ventral aspect without indication of a suture. This area on the ventral aspect has been termed the gula by systematists but there is certainly no morphological basis for the use of this term.

The antennal fossae are located on the front, slightly below the middle of the cephalic aspect.

The compound eyes are large, protuberant and extend very nearly the full dorso-ventral length of the head. On the cephalic aspect, the ventral part of each mesal margin is slightly concave to receive the antennal fossa. On the lateral aspect they occupy about the mesal third of the cephalo-caudal extension of the head.

Vertex.- The variations in this area are confined,

primarily, to its size and the character of the transverse carina which marks the extent of the insertion of the head into the prothorax.

Gradations in size are found between the long vertex of Fulvius(Fig.36) and Hyaliodes(Fig. 34) and the exceedingly short form shown in Pilophorus(Fig. 32). In this case the compound eyes attain the caudal margin of the head.

The carina is often wanting, its location being indicated merely by a line separating the smooth, polished, inserted area from the roughened, punctate, exserted area, as in Neuocolpus(Fig. 49) and Garganus(Fig.47).

Reuteroscopus(Fig. 29) and Platytylellus(Fig. 50) show the true carina in its least developed form. Strongly developed carinae are found in Monolocoris(Fig. 39) and Lygus(Fig. 44). Its greatest developement is reached in Strongylocoris(Fig.33) where it projects dorsad and caudad, concealing the cephalic margin of the prothorax.

The vertex is sometimes furrowed longitudinally. An extreme case of this is found in Cylapus(Fig. 12).

Front.- The front is quite variable within the group. Its most noticeable variation is in the abruptness with which it curves from the dorsal to the cephalic aspect of the head. Normally the curve is rather gradual, approaching the curve of a quadrant of a circle, Chlamydatus(Fig.28), Monolocoris(Fig. 39) and Sixeonotus(Fig. 40). The curve becomes very abrupt in Hyaliodes (Fig.34) and Cylapus(Fig.37). In other cases it is very gradual, giving a considerable horizontal extension to the head, Fulvius (Fig.36) and Strongylocoris(Fig.33). In Trigonotylus(Fig.51) the

front is largely confined to the dorsal aspect. The curve is very abrupt and the front extends for only a very short distance on the cephalic aspect.

It is usually slightly convex, Pilohporus(Fig.7), Strongylocoris(Fig.8); but is often quite strongly convex, Trigonotylus (Fig.26); the extreme of this type of variation being found in Clivinema(Fig. 13). In other species it is more or less concave, Cimatlan(Fig.17) and Coquillettia(Fig.10). In Cylapus(Fig.12), there is a furrow on the meson forming a deep v-shaped concavity.

Clypeus.- This is the most prominent feature of the capsid head. It is never separated from the front by a true suture, in many cases a more or less pronounced furrow extends between the clpeal furrows, definitely marking the line of union of the front and clypeus, Sixeonotus(Fig.15) and Clivinema(Fig. 13).

The distance between the clpeal furrows is a varying character, from the narrow type seen in Chlamydatus(Fig. 3) to the broad type of Reuteroscopus(Fig. 4). The clypeus also varies considerably in length, short in Camptobrochis(Fig.16) and long in Pseudoxenetus(Fig.15) and Miris(Fig. 27).

The clypeal furrows are usually very nearly parallel. They are occasionally widely divergent at their dorsal ends as in Sixeonotus(Fig.15) and Trigonotylus(Fig. 26). These furrows are often curved forming enlargements or constrictions in the width of the clypeus. Each is, in many forms, curved laterad at its point of junction with the mandibular suture, Pseudoxenetus(Fig.5), Miris (Fig. 27) and Monolocoris(Fig.14). In Cylapus(Fig. 12) there is a decided constriction of the ventral portion of the clypeus ventrad of the mandibular sutures.

The distance which the clypeus projects cephalad beyond the surrounding sclerites of the head, the shape or outline of the clypeus when viewed from the lateral aspect, and the direction of its long axis are all variable, in fact so greatly variable that the modifications probably do not present characters of more than specific value. The following are extreme types: Clivinema(Fig. 38), Trigonotylus(Fig. 51) and Neurocolpus(Fig.49). In Fulvius (Fig. 36) the clypeus is directed cephalad while in Cylapus(Fig. 37) it is directed caudad.

Labrum.- The modifications found in this sclerite seem to be of minor importance. The presence of setae suggests the possibility of their forming useful characters but studies on the constancy and position must be made before their value can be determined. In some forms the setae are entirely lacking. A single pair situated near the proximal end is the usual type,Hyaliodes (Fig.9), Strongylocoris(Fig. 8). Another group of species have two pair, one near the proximal end, the other near the middle, Cimatlan(Fig. 17) and Lygus(Fig. 18). Monolocoris(Fig. 14) possesses four pairs while Platytylellus(Fig. 50) and Sixeonotus (Fig.40) have a greater number. Lygus(Fig. 19) has one pair of large setae and several pairs of much smaller ones, while Miris (Fig.27) has several transverse rows of short setae.

In most species the form of the labrum is that of a narrow acutely pointed triangle. Intergradations are found between the extremely long and slender form of Fulvius(Figs. 11 and 36) and the short broad form of Reuteroscopus(Fig.4). The distal end is bluntly rounded in Poeciloscytus(Fig. 20) and Cylapus(Fig. 12).

The labrum, as seen from the side, also varies from the

thin lancet-like type of Coquillettia(Fig.35) and Clivinema(Fig.38) to the thick, blunt form of Cylapus(Fig. 37).

Jugae.- Although the jugae are parts of the front, they are best considered here as independent areas. Great variation in shape and extent occurs, due to differences in position and direction of the mandibular sutures. The jugae are relatively short in Cylapus(Fig. 11), where the mandibular sutures originate at the middle of the clypeus. These are the shortest ones found in the species studied. In no case do the mandibular sutures arise dorsad of the middle of the clypeus. The longest jugae are found in Adelphocoris(Fig.23), where they extend three fourths of the length of the clypeus.

In many cases the mandibular sutures extend very nearly at right angles to the clypeal furrows, extending laterad to near the lateral margins of the head where they bend abruptly dorsad toward the antennal fossae, Monolocoris(Fig. 14), Cimatlan(Fig.17), and Clivinema(Fig. 13). As a result the jugae are broadly quadrangular. These sutures extend in a slight curve from the clypeal furrows to the antennal fossae, Lopidea(Fig. 6) and Strongylocoris (Fig.8). The jugae are,in these cases, triangular in outline. A third type is found in those species in which the mandibular sutures extend in a strong curve to the antennal fossae, forming bluntly rounded jugae; Cylapus(Fig. 12) and Platytylellus(Fig. 25).

A furrow extends, in a few cases, laterad from the dorsal end of each clypeal furrow, apparently separating each jugum from the front, Clivinema(Fig. 13) and Sixeonotus(Fig. 15).

Hemimaxillae.- The hemimaxillae can best be studied from the lateral aspect. Their size and shape vary considerably.

The different position and direction of the mandibular sutures cause the hemimaxillae to vary inversely with the jugae. The size of the compound eyes also effects the extent of the hemimaxillae. Hyaliodes(Fig. 34) illustrates the small narrow type, Lopidea(Fig. 31) and Cylapus(Fig. 37) are excellant examples of the broad type. The former are the "low genae" and the latter the "high genae" of systematists.

The presence or absence of the genal furrow is another useful character. Cylapus(Fig.37) and Sixeonotus(Fig. 40) show extremes in the direction of this furrow. It is obsolescent on the ventral end in Pilophorus(Fig. 32) and Monolocoris(Fig. 39). Systematists describe this character by the expressions"genae distinct" when the furrow is present and "genae indistinct" when absent.

Bucculae.- The bucculae vary in size and in the distinctness with which they are separated from the hemimaxillae. Narrow well defined bucculae are found in Monolocoris(Fig. 39) and Lygus (Fig.44). They are exceptionally wide in Cylapus(Fig. 37) and Lygus(Fig.43). The furrow separating the buccula from the hemimaxilla is distinct, in some cases, only on the cephalic half, Pseudoxenetus(Fig.30) and Poeciloscytus(Fig. 45). In Poecilocapsus(Fig. 46) there is no indication of a furrow, the buccula extending in a regular and gradual flaring curve. It is of an unusual shape in Camptobrochis(Fig.41) where there is a large, rounded projection the ventral margin.

Postgenae.- There is very little variation in the postgenae. The only useful character found in these areas is the direction of the caudal part of the ventral margin of the lateral

aspect of the head. This line is parallel to the ventral margin of the clypeus in some species, Monolocoris(Fig.39) and Platytylellus(Fig.50), forms an obtuse angle with it in others,Reuteroscopus (Fig.29) and Lopidea(Fig.31), or is very nearly perpendicular to it, Sixeonotus(Fig.40).

Antennal fossae.- The antennal fossae vary greatly in location and somewhat in size. Their usual position being at the middle of the cephalic aspect, variations above and below this are found. They are placed near the ventral margin of the cephalic aspect in Camptobrochis(Fig. 16) and considerably above the middle in Pseudoxenetus(Fig.5)and Cylapus(Fig. 12). The two fossae are widely separated in Sixeonotus(Fig. 15) and Poecilocapsus(Fig.21) and relatively close together in Clivinema(Fig.13) and Platytylellus(Fig. 25). Very small fossae are found in Sixeonotus(Fig. 15) and unusually large ones in Trigonotylus(Fig. 26).

There is a prominent projection of the front in many species, at the ventro-caudal angle of each fossa, which serves as apoint of support and attachment,Lopidea(Fig. 31), Neurocolpus(Fig. 49) and Platytylellus(Fig. 50).

The front is bent cephalad beyond the adjacent surface of the head forming, on each side, a projecting ring, Hyaliodes(Fig. 34). The antennal fossae are located at the cephalic ends of these rings.

Compound eyes.- The compound eyes are variable in size, form and location, so much so, that in but few cases do they furnish characters of more than specific value. They occupy normally the cephalo-lateral portions of the head, they sometimes extend the full dorso-ventral length of the head, Cimatlan(Figs. 17 and 42).

In contrast with these enormous eyes are the small, oval ones of Sixeonotus(Fig. 40) and Miris(Fig. 52). They extend parallel to the dorso-ventral axis of the head, Reuteroscopus(Fig.29) and Coquillettia(Fig.35),or at an angle, Lygus(Fig.43) and Trigonotylus (Fig. 51).

The mesal margins are straight in Sixeonotus(Fig. 15), slightly concave, Clivinema(Fig. 13), or deeply emarginate, Lygus (Fig. 18) and Cimatlan(Fig. 17). The caudal margins are convex in Sixeonotus(Fig. 40), but are, usually emarginate, Fulvius(Fig. 36), Adelphocoris(Fig. 48). The emarginations differ in depth and position, sometimes forming a sharp caudal projection at the caudo-ventral angle, Camptobrochis(Fig.41) and Neurocolpus(Fig.49). The caudal margin is sometimes elevated by a dorso-lateral extension of a portion of the vertx, Cylapus(Fig.37) and Clivinema(Fig. 38).

Tentorium.- The tentorium is greatly reduced and modified. The supratentorium and pretentorium are wanting. Each metatentorium is a prominent, ribbon-like structure extending caudad from the ventral end of the clypeus to within a short distance of the occipital foramen. It is united with the basipharynx at its cephalic end. It extends parallel to the basipharynx throughout its length, the two structures forming a guide and support for a maxillary seta. A short distance from the caudal end, each metatentorium divides into two prongs, one continuing caudad, the other extending laterad. Near this point of division is attached the tendon from the maxillary seta. These structures are practically the same in all the forms studied.

VI. THE MOVABLE PARTS OF THE HEAD.

Many of the movable parts of the head have been greatly modified from those of generalized insects. The homologies have, however, been clearly shown by various workers.

Antennae.- Each antenna consists of four segments. The typical antenna, Lopidea(Fig. 55), has a short thick proximal segment, the scape, a much longer more slender second segment, the pedicel, a long, still more slender third segment, and a short, very slender fourth segment. The segments are clothed with fine setae, long on the scape and successively shorter on the other segments.

The scape varies in length and thickness. It is very short in Chlamydatus(Fig. 53), long and very slender in Hyaliodes (Fig. 56) and long and greatly thickened in Neurocolpus(Fig. 64). The vestiture also varies, from the glabrous condition of Pseudoxenetus(Fig. 54) to those densely covered with long fine setae, Miris(Fig.65). A very unusual type is found in Neurocolpus(Fig. 64) where it is densely covered with long clavate setae.

The pedicel also varies in length and form. It is long and linear in Hyaliodes(Fig. 56) and Miris(Fig. 65), short and slightly clavate in Monolocoris(Fig. 58) and Chlamydatus(Fig. 53), long and strongly clavate in Neurocolpus(Fig. 64). In Garganus (Fig. 62) and Poeciliscytus(Fig. 60) it is fusiform, while in Cylapus(Fig. 57) it is extremely slender, slightly enlarged at each end.

This segment bears a few scattered, stiff setae in Cylapus (Fig. 57) and Cimatlan(Fig. 59). It is densely covered with long, fine setae in Garganus(Fig. 62) and Miris(Fig.65). In other

other species, the hairs, although dense, are very short, Chlamydatus(Fig. 53) and Adelphocoris(Fig. 63)

The species studied fall into two distinct groups in regard to the length of the third segment. It is either approximately as long as the pedicel,Chlamydatus(Fig. 53) and Adelphocoris (Fig. 63) or one half as long, Cimatlan(Fig. 59) and Poeciloscytus (Fig. 60). It also varies in thickness. It is slightly thinner than the pedicel in Miris(Fig. 65), very much thinner, almost thread-like, in Poeciloscytus(Fig. 60) and Garganus(Fig. 62), and of the same thickness in Cimatlan(Fig. 59). In Monolocoris(Fig. 58) it is enlarged at the proximal end, tapering gradually to the small distal end. It is uniformly, densely covered with fine, short setae. A few much longer setae are also found on the distal end of this segment in Trigonotylus(Fig. 66).

The fourth segment is , in most cases, short, slender and uniform in thickness throughout. In Cylapus(Fig.57), however, it is very long and thread like, while in Cimatlan(Fig. 59) it equals the other segments in thickness. It is uniformly covered with short, fine setae. A few longer setae are also present in Trigonotylus(Fig. 66).

Mandibles.- The mandibles, as in all Heteroptera, are modified into long,slender, piercing organs(Fig. 67a). The distal end of each mandible is curved and bears a row of teeth on the convex side. The proximal end is enlarge and withdrawn into the head. The articulation, as previously stated, is with an invagination at the end of the mandibular suture. This invagination is in the form of a chitinized, triangular piece, movably attached by one angle to the head capsule. A tendon extends from a second

angle to a point of the dorsal margin of the mandible, slightly distad of the proximal end. The apex of the triangle is directed caudad and from this angle a muscle extends to the head capsule. This is the retractor muscle. The protractor muscle is attached to the base of the triangle. A second retractor muscle is attached to the proximal end of the mandible.

The variations in these structures could not well be used in a sustematic treatment of the group and are not considered in this article.

Maxillae.- The maxillae(Fig.68), like the mandibles, are modified to form piercing organs. They are slightly longer than the mandibles and are locked together forming a tube through which the liquid food may be drawn into the mouth. The distal end of each maxilla is straight and sharply pointed. The extreme tip is smooth but two longitudinal rows of small sharp teeth occur just proximad of this area. The proximal end is enlarged and with drawn into the head, reaching nearly to the occipital foramen. The portion of the maxilla within the head is supported on the mesal side by the basipharynx and on the lateral side by the metatentorium. It is attached, near the proximal end, to the tentorium by means of tendons.

Labium.- The labium is modified into a long sheath or rostrum, composed of four segments. The labium of Chlamydatus associatus (Fig. 69) has been taken as typical of the group. The proximal segment is rather short and thick, longer on the dorsal aspect than on the ventral. It is united to the bucculae by an area of membrane which is very wide on the ventral margin, allowing free dorso-ventral movement. The second, third and fourth

segments, as seen from the lateral aspect, are more slender than the first and form a long tube which gradually tapers to a sharp point at the distal end. The second segment is the longest, the third is one-third shorter, the fourth approximates the second in length. The distal end of the second and the proximal end of the third are broadened on the dorsal aspect.

A deep furrow extends along the meson of the dorsal aspect. The mandibles and maxillae lie in this furrow. It is broad and deep on the first segment becoming gradually narrower on the second until, on the third and fourth segments, the lateral margins of the labium meet on the meson, completely roofing over the furrow. The mandibles and maxillae are free from the sides of the furrow in the proximal segment but are held firmly in place by them on the second, third and fourth segments.

The shape and size of the proximal segment is the most variable character in the labium. It is a cylindrical tube in many species, Monolocoris(Fig. 74) and Pilophorus(Fig. 72). The distal end is greatly enlarged in certain species, Hyaliodes(Fig. 73) and Neurocolpus(Fig. 78). The comparative legnth of the segments also varies. The most noticable variation is the elongation of the distal segment, making it the longest one of the series, Poecilocapsus(Fig. 76) and Hyaliodes(Fig. 73). The distal end of the second segment and the proximal end of the third are greatly widened on the dorsal aspect in Miris(Fig. 81). The two distal segments in Sixeonotus(Fig. 75) are short and greatly dilated. In this respect they differ from all the other species studied.

VII. THE PROTHORAX.

The prothorax is a large, well defined segment in the Capsidae. Its variations furnish a number of important characters in the classification of the group.

Typical prothorax.- The prothorax of Chlamydatus associatus(Figs. 82, 107 and 120) has been selected as an illustration of the simplest type. The notum, pleura and sternum are in their normal positions. The notum is quadrangular and is greatly expanded caudad, projecting for a considerable distance over the mesonotum. The caudal margin is much wider than the cephalic.

The cephalic margin is bent abruptly ventrad for a short distance, forming the dorsal margin of the cephalic proforamen. The proconjunctiva is attached to this ventral edge. The caudal margin is infolded and forms the ventral surface of the notum for about half its length, where it turns abruptly ventrad and unites with the mesoconjunctiva. Near each cephalo-lateral angle there is an irregular raised area known by systematists as a callosity. The large muscles of the prothoracic leg are attached to the ental surface of this callosity.

The pronotum bends ventrad on each lateral margin and extends about one-half the length of the lateral aspect where it unites with the pleural sclerites without indication of a suture. The pronotum bears scattered, fine setae. At each cephalo-lateral angle there is a large, stiff seta.

The pleural suture of each side originates at the cephalo-lateral angle of a procoxal fossa and curves dors-cephalad almost to the cephalic margin of the prothorax. The small area cephalad of this suture is the proepisternum. The area caudad of it is the

proepimeron. The dorsal end of the suture is obsolete and the proepisternum and the proepimeron are fused at this point. There is no suture between these pleural sclerites and the pronotum.

The cephalo-ventral angle of each proepisternum fuses with a narrow lateral arm of the prosternannum. The caudal portion of each lateral aspect, composed of fused pronotum and proepimeron bends ventro-mesad and forms the latero-caudal margin of the procoxal fossa. It unites at its caudo-mesal angle with the membranous lateral portion of the prosternellum.

The prosternum forms the ventral aspect. It does not extend as far caudad as the pronotum, A procoxal fossa occupies each lateral third. The sternannum is the large sclerite between the procoxal fossae. A triangular arm extends laterad, on each side, forming the cephalic boundary of a procoxal fossa. The lateral end of this arm is very slender and unites with the proepisternum without indication of a suture. The median, quadrangular part of the prosternannum, known by systematists as the prosternal xyphus, bears a y-shaped elevation. The stem of the y is directed caudad. At each caudo-lateral angle of this area is located a well defined furcina. The area caudad of the profurcinae is the prosternellum. It is not separated by a suture. The only chitinized portion of this sclerite is a very small, mesal, pointed area. The remainder is membranous and bounds the caudal margins of the procoxal fossae. There is no suture between the prosternellum and the mesoconjunctiva. The caudal end of the chitinized point probably marks the caudal extent of the prosternellum.

The endoskeleton may be seen from the ventral and caudal aspects (Figs. 107 and 120). The profurcae are short, broad pro-

jections directed dorso-laterad. The procoxal processes are short, blunt knobs at the ventral ends of the pleural sutures. The entopleuron consists of a long, slender, triangular process on each side originating near the dorsal end of the propleural suture and extending caudo-meso-ventrad nearly to the profurca. They are readily seen within the procoxal fossae.

Pronotum.- The pronotum presents some striking modifications which have been used by systematists. One such modification, which is given great importance in the present classification, consists of a constriction of the cephalic portion forming a collar. This constriction is continued over the lateral margins of the pronotum. It is often separated from the rest of the pronotum by a distinct transverse furrow, Lygus(Fig. 91) and Garganus(Fig. 95). The collar is usually very short but in Platytylellus(Fig. 98) it is quite long. The furrow is sometimes wanting and the collar is long, flat and poorly defined, Trigonotylus(Fig. 99) and Miris (Fig. 100).

Tribes have been based primarily on the presence or absence of this collar. Its presence appears to be largely a question of degree, easily misinturpreted and overlooked, and, as used at present, having no phylogenetic value. Pilophorus(Fig. 85)and Strongylocoris(Fig. 86) are species supposedly without a collar. It is present in both species but cannot be seen unless the head is removed. Lygus(Fig. 92) and Poeciloscytus(Fig. 93) have very short collars which may be readily overlooked.

The size and form of the callosities vary greatly, from the small oval ones in Strongylocoris(Fig. 86) to the very large, confluent ones in Fulvius(Fig. 88) where they cover the cephalic

half of the pronotum.

The caudal margin is convex in many cases, Strongylocoris (Fig. 86) and Poecilocapsus(Fig. 94), slightly concave in others, Pseudoxenetus(Fig. 83) and Neurocolpus(Fig. 97). In Trigonotylus (Fig. 99) it is very strongly concave.

The extent of the recurved caudal margin varies considerably. The edge is often visible as a dark line through the transparent cuticle of the pronotum.

The anterior margin is also recurved in many cases. The extent of this infolding is not as great as that of the caudal margin. It usually reaches the furrow caudad of the collar or to the anterior margins of the callosities. The extent of these infoldings in Miris is indicated by the dotted lines in Figure 119.

The vestiture also presents many modifications. A few scattered setae occur in Pseudoxenetus(Fig. 83), in other species there is a dense covering of fine setae, Lygus(Fig. 92) and Platytylellus(Fig. 98). The setae are coarse and situated in deep punctures in Hyaliodes(Fig. 87) and Cimatlan(Fig. 90) while in Neurocolpus(Fig. 97) the setae are practically obsolete leaving the surface coarsely punctured. The punctures in which the setae are located are very small in some species, Lygus(Fig. 92). Large setae occur on the callosities and collar in some cases, Hyaliodes (Fig. 87) and Adelphocoris(Fig. 96).

Propleura.- The variations of the propleura in size and form are specific and do not furnish group characters. The other variations are few and of minor importance. The extent and direction of the propleural sutures are quite different in some of the species studied. They do not approach, in most cases, so closely

to the cephalic margin of the pronotum as in Chlamydatus. They extend more directly dorsad and reach to near the middle of the lateral aspect. There is a longitudinal furrow at the dorsal end of the propleural suture in Miris(Fig. 119) and the point of invagination of the proentopleuron is distinctly visible. The ventral margins of the proepisternum and proepimeron are produced as convex projections, in many cases, concealing the point of articulation of the procoxa.

Prosternum.- Characters of the prosternum have been used by systematists and, while they are often difficult to see, they are undoubtedly useful.

The prosternannum is the most variable sclerite. It is sometimes concave but usually more or less convex. It has a prominent pointed ridge in many cases, the point of the ridge is directed caudad, Miris(Fig. 101) and Lygus(Fig. 111). The caudal portion is memoranous in Adelphocoris(Fig. 103). The cephalo-lateral projection extending cephalad of the procoxal fossae varies greatly in size with the migration of the procoxal fossae from the cephalic margin of the prosternum, Pilophorus(Fig. 112) and Trigonotylus (Fig. 108) illustrate the extremes of this variation. The profurcinae are always well defined. Their position varies only in regard to the distance between them. This is depentent entirely upon the width of the insect and does not furnish a reliable character.

The sternellum is in many cases entirely membranous, Adelphocoris(Fig. 103) and Hyaliodes(Fig. 109). The largest amount of chitinization occurs in Trigonotylus(Fig. 108) and Miris (Fig. 101), where a large, triangular area extends caudad from the

profurcinae. A very small profurcella occurs in three species, Cimatlan(Fig. 113), Lygus(Fig. 111) and Hyaliodes(Fig. 109). Two tendons extend caudo laterad from the profurcella into the mesothorax in Hyaliodes.

Endoskeleton.- The parts of the endoskeleton vary in size but they are essentially similar in the species studied.

The profurcae are always simple, dorsal or dorso-lateral projections. They are short and slender in Pilophorus(Fig. 122) and Camptobrochis(Fig. 125) while in Poecilocapsus(Fig. 130) and Trigonotylus(Fig. 134) they are unusually long.

The procoxal process shows no important variation.

The proentopleuron varies somewhat in the shape and size of its projection. They are long and slender and curve ventromesad in Pilophorus(Fig. 122) and Cimatlan(Fig. 126). They reach the apices of the profurcae in Poecilocapsus(Fig. 130) and Trigonotylus(Fig. 134), while in Lygus(Fig. 127) they are short, triangular and project directly mesad.

VIII. THE MESOTHORAX AND METATHORAX.

The mesothorax and metathorax of the Capsidae are highly specialized structures. They depart widely from those of primitive insects.

Typical Mesothorax and Metathorax.- Chlamydatus associatus is taken as typical of the group. The mesoconjunctiva and the mesoprescutum are invaginated, forming the mesoprephragma. The suture separating these two areas is obsolete. The phragma is a prominent plate on the mesal third and becomes rapidly smaller on each side until, at the lateral ends, it is obsolete. The caudal surface of the phragma only is slightly chitinized on its mesal third.

The mesoscutum is a large convex sclerite. The cephalic margin is slightly concave. The cephalo-lateral angles are rounded. Each lateral margin extends caudo-laterad for about one-third the length of the mesoscutum. At this point there are two small lateral projections. The cephalic projection is the mesomedalaria, the caudal one, the mesocaudalaria. They serve for the articulation of the mesowings. The mesocephalaria is absent. Caudad of these projections the lateral margins extend caudo-mesad meeting each other on the meson at an acute angle. The mesoscutum projects as a large triangular area over the cephalic half of the metanotum. A short distance each side of the meson, at the cephalic margin, there originates a suture which extends caudo-laterad for about one-third the length of the mesoscutum where it bends abruptly mesad and disappears. These sutures are the parasideae and the area enclosed the parapsidea.

The mesoscutellum is divided into two parts by the caudal

extension of the mesoscutum. It is represented by a narrow, convex area originating at the caudal third of each lateral margin of mesoscutum, and extending cephalo-laterad along its lateral margin to a point a short distance caudad of the mesocaudalaria where it projects laterad free from the mesoscutum. It is separated from the mesoscutum by a deep furrow in which lies the anal margin of the mesowing when at rest. The mesospiralaria extends from the caudo-lateral angle of the mesoscutellum to the anal margin of the wing. A prominent, linear wing sclerite articulates with its cephalo-lateral angle.

The metapostscutellum is attached to the caudal margin of the meso-scutellum, is recurved and extends cephalad, lining the mesoscutellum and the caudal half of the mesoscutum. Its cephalic extent is seen on the dorsal aspect as a dark transverse line. Along this line it is recurved and extends caudad, in close proximity to the ectal surface, to a line just cephalad of the caudal end of the mesoscutum. It is membranous with the exception of two quadrangular areas, one on each lateral margin of the mesoscutum. These areas are the only parts exposed.

The meataconjuctiva is attached to the caudal margin of the mesopostscutellum, and, together with the metaprescutum, forms the metaprephragma. The limits of these two areas are not defined by sutures. The metaprephragma is large and strongly chitinized. It extends ventro-caudo-mesad to near the caudal margin of the thorax. It is strongly convex, the lateral portions curving sharply ventrad. The ventro-caudal angles are prolonged into short, blunt projections. Each projection extends ventrad and lies in close proximity to a metafurca.

The metascutum is triangular on the meson, The cephalic portion extends beneath the mesoscutum, the apex of the triangle extends caudad to the caudal margin of the thorax. It extends laterad and slightly cephalad, from each cephalo-lateral angle of this triangular area, as a narrow band for about half the distance to the lateral margin of the thorax. The anterior margin bends suddenly cephalo-laterad to the lateral margin, forming a large triangular area.

There is a short lateral projection at each caudo-lateral angle of the metascutum. A furrow, originating at the cephalic margin of each projection, extends caudo-mesad along the caudal margin of the metascutum disappearing some distance some distance from the meson. These projections and the area caudad of these furrows form the metascutellum. The metaspiralaria extends from the caudal margin of the metasternellum to the caudal margin of the metawing.

The metapostscutellum is divided on the meson by the caudal projection of the metascutum. Each lateral area forms a broad band across the caudal margin of the metanotum. There is a sharp, triangular projection extending cephalad from each cephalo-lateral angle. These projections extend considerably cephalad of the projecting metascutellum.

The metapleura and the metastenum form a continuous convex area(Fig.149). All the parts are visible from the ventral aspect and will be considered together.

The mesosternannum is a large sclerite occupying the larger part of the cephalic half of the ventral aspect. It is divided on the meson by a distinct furrow which marks the position of an

invaginated plate. Along each caudo-lateral margin lies a large, oblong mesocoxal fossa. The mesosternannum extends caudad on the meson between the mesocoxal fossae and bends abruptly, extending dorsad for a short distance. At each caudo-lateral angle of this mesal projection is a mesofurcina.

Caudad of the mesofurcinae is a narrow area of membrane, the mesosternellum. This sclerite forms the caudo-mesal boundary of each mesocoxal fossa and does not extend laterad of them.

There is a small, triangular sclerite at each cephalo-lateral angle of the mesoscutum, a mesoepisternum. Its connection with the coxal process has been lost. Each pleural suture originates at the cephalo-lateral angle of a mesocoxal fossa and extends cephalo-laterad in a sinuate course to the lateral margin of the mesothorax, slightly caudad of the cephalic margin. It extends nearly cephalad for a short distance, bends laterad and again turns cephalad to the caudal margin of the mesoepisternum, where it bends laterad and extends to the lateral margin. Laterad and caudad of this suture is a long, narrow sclerite, the mesoepimeron. It extends caudad to the caudal margin of the mesothorax and forms the lateral boundary of the mesocoxal fossa.

The msospiracles are large and situated in the meso-conjunctiva, one on each side of the meson, half the distance to the lateral margin.

The metasternannum is a long, narrow sclerite extending along the cephalic margin of the metathorax. The mesal third is oval. Laterad of this area, at the caudo-mesal angle of each mesocoxal fossa, it becomes very narrow then gradually widens laterad, filling the space between the mesocoxal and metacoxal fossae.

Near the lateral margin of the thorax it bends abruptly cephalad and extends to the middle of the lateral margin of the mesoepimeron. This sclerite forms the cephalic boundaries of the metacoxal fossae. There is a long incission in this sclerite extending cephalo-laterad from each cephalo-mesal angle of the metacoxal cavities. A stink gland is everted from each of these incissions.

The portion of the caudal margin the metacoxal fossae bends dorsad for a short distance. At each dorso-lateral angle is located a metafurcina.

The metasternellum is limited to a narrow area of membrane caudad of the metafurcinae and mesad of the metacoxal fossae.

A metapleural suture originates at the cephalc-lateral angle of each metacoxal fossa. It extends cephalo-laterad and bends dorsad onto the dorsal aspect, where it extends cephalo-mesad to the pleural conjunctiva.

The metaepisternum of each side is fused with the metasternannum without indication of a suture. Its connection with the metacoxal process has been lost.

Each metaepimeron consists of a small, triangular area on the ventral aspect. The apex of this triangle extends caudad and forms the lateral boundary of a metacoxal fossa. The metaepimeron bends onto the dorsal aspect and extends as a long, narrow band along the lateral margin of the metapostscutellum.

The spiracles of the metathorax are located in the interpleural suture, one on each side midway between the meson and the lateral margin of the thorax. They are not visible externally.

The endoskeleton is well developed. The mesoprephragma and the metaprephragma have already been described. The meso-

furcae are very large. They project latero-caudo-mesad along the mesal margins of the metacoxal cavities. Each mesofurca forks at the middle of its lateral margin. Each fork extends cephalo-laterad to near the lateral margin of the mesothorax. It is broad and flat at its proximal end becoming narrower and less strongly chitinixed at the distal end. This end enlarges suddenly forming a cup-shaped disk. The mesoentopleuron is a short triangular invagination extending mesad from the middle of the length of each mesopleural suture. Its apex approximates the enlarged distal end of a mesofurca. The mesocoxal processes are small.

The metafurcae are strong, straight prongs extending latero-caudo-mesad, articulating with the caudo lateral ends of the metaprephragma. The metacoxal processes are small.

Mesonotum.- The msonotum varies somewhat in form and size. The cephalo-caudal diameter is long in some species, the caudal end extending onto the first abdominal segment, Pilophorus (Fig. 139) and lygus(Fig. 144). It is short in other species, reaching only to the middle of the metascutum, Strongylocoris(Fig. 143) and Adelphocoris(Fig. 146). It does not attain the metascutum in Reuteroscopus(Fig. 137) and Lopidea(Fig. 138).

The distance between the mesomedalaria and the mesocaudalaria also varies. They are very close together in Cimatlan (Fig. 143) and Trigonotylus(Fig. 147), and at a considerable distance from each other in Lopidea(Fig. 138) and Adelphocoris(Fig. 146).

The mesosternellum varies in length and width, being short and narrow in Trigonotylus(Fig. 147) and Miris(Fig. 148), long and broad in Pseudoxenetus(Fig. 137) and Hyaliodes (Fig. 141).

The mesopostscutellum shows very little variation. The only important one being the cephalic extent of the incurved portion.

Mesopleura.- These areas furnish no important charcaters. The mesoepisternum varies only slightly in size and shape. The cephalic portion of the caudo-lateral margin of the metaepimeron is expanded in some forms, forming a feww projection overlapping a part of the metasternannum. It is often separated from the rest of the sclerite by a furrow, Lopidea(Fig. 150) and Adelphocoris(Fig. 151).

Mesosternum.- This region also lacks characters of importance. The mesosternannum differs only slightly in size and shape. The mesosternellum is in some cases entirely chitinized and fused with the metasternannum without indication of a suture, Lopidea(Fig. 150) and Miris(Fig. 152).

Mesoendoskeleton.- The mesoendoskeleton is essentially the same in all the species studied. It differs only in comparative size.

Metanotum.- The metanotum varies only in minor details. The metascutum varies in size and form, especially on its mesal third, Hyaliodes(Fig. 141) and Adelphocoris(Fig. 146). There is as small projection, in some species, at the middle of each lateral margin. This is probably the metamedalaria, Strongylocoris (Fig. 140) and Lygus(Fig. 144).

The furrow separating the metascutum and the metascutellum is deep and extends completely across the sclerites in some forms, Lygus(Fig. 144) and Poecilocapsus(Fig. 145).

The metapostscutellum varies only slightly in form and

size. The cephalo-lateral projections are entirely wanting in Strongylocoris(Fig. 140) and Camptobrochis(Fig. 142).

Metapleura.- Variations in the size and extent of the metaepimera furnish the only character of importance in the metapleura. They are confined, alomost entirely, to the dorsal aspect in Lopidea(Fig. 150). A long caudo-mesal projection occurs in Miris(Fig. 152), forming the caudo-lateral boundary of each metacoxal fossa.

Metasternum.- The metasternum furnishes few characters of value. The size of the metasternannum varies greatly. It is unusually small in Adelphocoris(Fig. 151) and large in Miris(Fig. 152).

The stink glands are often mere slits on the surface of the metasternannum, while in other species the mouth of the gland is everted forming a prominent membranous projection. These vary in shape in different species.

The metasternellum is sometimes entirely chitinized, Lopidea(Fig. 150) and Miris(Fig. 152).

Metaendoskeleton.- The metaendoskeleton is essentially the same in all the species studied, varying only in comparative size.

IX. THE APPENDAGES OF THE THORAX.

The appendages of the thorax are not highly specialized, nor do they present much variation within the family.

Legs.- The legs are of the typical cursorial type. The three pairs are similar in structure and differ only in size. The metathoracic pair is the largest and forms the basis for the following description. The metathoracic leg of Miris(Fig. 157) is taken as typical.

The trochantin, while a sclerite of the sternum, is best studied in connection with the leg. It is a long oval sclerite extending along the lateral half of the proximal margin on the dorsal aspect of the coxa. The proximal end articulates with the coxal process. The distal end articulates with a small acetabulum at the middle of the cephalo-proximal margin of the coxa.

Each leg is composed of a coxa, trochanter, femur, tibia, and three-segmented tarsus.

The coxa is the shape of a truncated cone. The distal end is smaller than the proximal. The lateral margin is much longer than the mesal, the proximal margin being deeply concave. A few long setae occur on the lateral aspect. The mesal aspect is densely covered with short setae.

The trochanter is composed of two segments. This fact has apparently been overlooked by all previous observers as no referrence to it has been found in the literature. It is very evident in the nymph, Miris(Fig. 156), where, besides the deep constriction, the suture is plainly evident. It is less well defined in the adult although still present. The proximal segment is small and articulates with the distal end of the coxa.

The distal segment is larger and is united with the lateral margin of the first segment. The distal end is oblique and is immovably united with the proximal end of the femur. The ventral margin of both segments bears a number of setae.

The femur is long and stout. The ventral margin is straight, the dorsal slightly convex. The distal end is slightly narrower than the proximal. There is a slight cephalo-caudal compression. It bears a number of strong setae.

The tibia is long and slender, about one-third longer than the femur. It is somewhat enlarged at the distal end. It is covered with long stiff setae.

The tarsus consists of three segments, two in the nymph. They are more slender thab the tibia and are all equal in width. The first segment is longest, the second much shorter, the third very little shorter than the first. The dorsal aspect of each segment bears a few long, slender setae. The ventral surface is densely covered with short, fine setae.

The articularis consists of two large, sharply pointed claws. Between these claws is a triangular planta, the apex of the triangle is directed dorsad. Each ventro-lateral angle bears a large, curved, clavate arolia, the distal ends of which approximate each other.

The trochantin and coxa vary but slightly, except in size. They do not present characters of phylogenetic value.

The femora vary considerably in width and thickness. Chlamydatus(Fig. 158) shows a short wide type which has a very great cephalo-caudal compression. The femor being ribbon-like in form. This type is very common in the group.

The variations in the vestiture of the tibia furnish the only characters of value in this segment. They bear long, spine-like setae in addition to a dense covering of short ones in many species, Adelphocoris(Fig. 160) and Lopidea(Fig. 161). These spine-like setae are wanting in some other species, the tibia being clothed only with long, stiff setae.

The tarsal segments vary considerably in comparative length. This variation furnishes valuable characters for the classification of the group. In Monolocoris(Fig. 159) the distal segment is greatly enlarged. The distal ends of the segments are oblique in many forms so that the ventral margin extends much further distad than the dorsal margin, Chlamydatus(Fig. 158) and Adelphocoris(Fig. 160).

The form and direction of the aroliae furnish the most valuable character found in the articularis. There are several types of these variations. They are large, clavate and curve toward each other at the distal end in Lopidea(Fig. 162). In other species they are rather slender, sharply pointed and divergent at the distal end, Poecilocapsus(Fig.163). In Cimatlan(Fig. 164), they are reduced to mere bristles but are still divergent. In still other species they are bristle-like but parallel, Chlamydatus(Fig. 165) and Reuteroscopus(Fig. 166). These species also possess a peculiar membranous structure attached to the shoulder of each claw. The homology of this structure is not known. It has been described by systematists as the arolia which has become united with the claws. They have, however, overlooked the fact that the arolia are present in their normal position. These structures, therefore, cannot be homologous with them but are prob-

ably secondary developements.

Wings.- The wings do not differ greatly from the heteropterous type. They present some characters of value, however. The wings of Chlamydatus associatus will serve for description.

The mesowing(Fig. 173), as in most Heteroptera, is separated into several distinct areas. The corium occupies the median and costal areas, the clavus the anal area and the membrane the distal third. The corium and clavus are separated by a furrow, the anal furrow of Comstock and Needham, 1898, the claval suture of systematists. This anal furrow is very deep.

The corium is indented on the costal margin near its distal end and a short transverse furrow extends toward the middle of the wing, cutting off a short area known as the cuneus. The membrane contains two basal cells, the caudal one large and the cephalic small.

The metawing(Fig. 174) is entirely membranous and contains relatively few veins. The homologies of these have not been worked out. There is a long narrow cell along the costal margin of the wing with a longitudinal vein extending from its apex and another from the caudo-distal angle. The base of the latter vein is continued for a short distance within the cell. This portion of the vein has been termed the hamus by systematists.

characters of value in the mesowing are found in the distinctness and depth of the anal furrow and in the depth of the cuneal fracture. In Strongylocoris(Fig. 183) the anal furrow is very deep, the clavus being almost completely separated from the corium. In Miris(Fig. 203) the cuneal fracture is small and inconspicuous, while in Pilophorus(Fig.181) it is very deep and the

cuneus and membrane are strongly deflexed. There is a single cell in the membrane in Monolocoris(Fig. 187).

The presence or absence of the hamus in the metawing furnishes the only character of value.

X. THE ABDOMEN.

The abdomen consists of ten segments. It is similar in general characteristics to that of most of the other Heteroptera. The abdomen of Miris dolobrata has been selected as typical.

Tergum.- The dorsal aspect consists of ten terga. The first tergum in the male(Fig. 169) is membranous on its cephalic half. It is not as wide as the succeeding ones. The cephalic margin of the second is concave, the cephalo-lateral angles projecting cephalad along the lateral margins of the first. The caudal margin is straight. The cephalic margin of the third is straight and the caudal margin concave. It equals the second in width. The fourth, fifth, sixth and seventh terga are similar in form and size to the third. The eighth is slightly shorter than the preceeding terga and the lateral margins converge caudad so that the caudal margin is shorter than the cephalic. The ninth is twice as long as the eighth. The lateral margins are convergent. The caudal margin is deeply concave with a small caudal projection on the meson at the bottom of the concavity. The caudo-lateral angles are produced into cerci-like processes. The tenth tergum is placed in the concavity of the caudal margin of the ninth and projects slightly beyond the caudo-lateral extremities of this segment. It is membranous and its caudal margin is densely covered with setae.

A short distance mesad of each lateral margin of terga two to seven, there extends a furrow separating a small lateral area on each tergum. These areas form the connexivum of systematists. They have been considered homologous with the pleura but,as there is no indication of sutures or furrows in the nymph,

they must be cosidered as secondary developements.

The first pair of spiracles is located on the first tergum, one spiracle close to each lateral margin. They are small and inconspiculous.

Terga one to seven of the female(Fig.167) are similar to those of the male excepting that terga two to four are successively wider and terga five to seven successively shorter. The lateral margins of the dorsal aspect are,therefore, slightly arcuate. The eighth tergum is similar to that of the male but slightly longer. The caudal margin of the ninth is straight and much shorter than the cephalic margin. The tenth tergum is largely withdrawn into the abdomen, only a small caudal portion being exposed.

The connexiva are similar but much larger than in the male and are bent mesad and lie on the dorsal surface of the abdomen, the ventral face of the connexiva being directed dorsad.

Spiracles two to seven occur on the ventral surface of each connexivum and are thus visible on the dorsal aspect. The first pair of spiracles are located as in the male.

Sternum.- The ventral aspect differs considerably in the male and female, due to the different form and position of the genitalia.

The first sternum in the male(Fig. 170) is membranous with the exception of two small, chitinized bars, one on each side of the meson of the cephalic margin. The cephalic margin of the second sternum is deeply concave, the lateral portions extending along the lateral margins of the first sternum. The caudal margin is slightly concave. The cephalic margin of the third is convex and the caudal margin concave. Sterna four, five, six and

seven are similar in shape and size to the third. The caudal margin of the eighth is slightly more convex than that of the seventh and is shorter than the cephalic margin, the lateral margins being slightly convergent. The ninth is nearly three times as long as the eighth and is decidedly convex and hood-like. The caudal margin is strongly convex. The tenth sternum is wanting.

A furrow appears near each lateral margin of sterna two to seven separating the ventral portion of the connexivum.

Spiracles occur in each cephalo-lateral angle of sterna two to eight.

Sterna one to five of the female(Fig. 168) are similar to those of the male except that they are successively a little wider. The sixth is a little narrower than the fifth but similar in form excepting a small triangular projection on the meson of the caudal margin. The seventh, eighth and ninth are divided on the meson by the ovipositor and guidesor pygofers. The eighth and ninth are are much longer than the seventh. Each lateral portion of the ninth is triangular in outline, the rounded apex directed caudad.

The spiracles on the eighth sternum are visible from the ventral aspect, being located at the cephalo-lateral angles.

Genitalia.- The genitalia do not furnish characters of more than specific value and are only briefly mentioned here.

The external genital organs of the male(Fig. 172) consist of an asymmetrical pair of claspers. One of them is long and sharplypointed, the other, short and club-shaped.

The ovipositor of the female is slender and sword-like, it is attached beneath the sixth sternum and extends to the caudal end of the abdomen. It is supported on each side by a broad, thin

plate, a guide or pygofer.

XI. SUMMARY.

The fact that there is a surprising lack of diversity in the structure of these insects has been brought out by this study. A much greater degree of variation might be expected in a group containing some three hundred species which have been divided into one hundred and twenty-four genera. It is very evident that the present classification is entirely artificial.

Modifications of the head capsule and of the articularis offer the best characters for a phylogenetic classification, with the modifications of the prothorax, antennae and wings of secondary importance.

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XIII. LIST OF ABBREVIATIONS USED IN THIS WORK.

The numerals 1, 2, and 3 following an abbreviation refer, respectively to the prothorax, mesothorax and metathorax.

a.- antenna
ar.- articularis
arl.- arolia
bu.- buccula
c.- coxa
ca.- callosity
cf.- clypeal furrow
cl.- clypeus
clv.- clavus
co.- collar
cor.-corium
cs.- clasper
cu.- cuneus
cx.- connexivum
cxp.- coxal process
e.- compound eye
enp.- entopleuron
epm.- epimeron
eps.- episternum
es.- epicranial suture
fc.- furca
fcl.- furcella
fcn.- furcina
fm.- femora
fr.- front
fr.- front
g.- gena
gf.- genal furrow
h.- hamus
hm.- hemimaxilla
ju.- jugum
lb.- labium
lr.- labrum
mb.- membrane
ms.- mandibular suture
n.- notum
pa.- planta
pg.- postgena
ph.- phragma
pls.- pleural suture
ps.- prescutum
psc.- postscutellum
py.- pygofer
s.- scutum
sc.- scutellum
sg.- stink gland
sl.- sternellum
sn.- sternannum
sp.- spiracle
spr.- spiralaria
st.- sternum
t.- tergum
ta.- tarsus
ti.- tibia
tn.- trochantin
tr.- trochanter
v.- vertex

Explanation of Plate I.

Fig. 1. Fourth Stage Nymph of Miris dolobrata(Linn.) Dorsal aspect of the head.

Fig.2. Early Nymph of Adelphocoris rapidus(Say). Dorsal aspect of the head.

Fig.3. Chlamydatus associatus(Uhl.). Cephalic aspect of head.

Fig.4. Reuteroscopus ornatus(Reut.). Cephalic aspect of head.

Fig.5. Pseudoxenetus scutellatus(Uhl.). Cephalic aspect of head.

Fig.6. Lopidea media(Say). Cephalic aspect of head.

Fig.7. Pilophorus schwarzi Reut. Cephalic aspect of head.

Fig.8. Strongylocoris stygicus(Say). Cephalic aspect of head.

Fig.9. Hyaliodes vitripennis(Say). Cephalic aspect of head.

Fig.10. Coquillettia amoenus(Uhl.). Cephalic aspect of head.

Fig.11. Fulvius brunneus(Prov.). Cephalic aspect of head.

Fig.12. Cylapus tenuicornis Say. Cephalic aspect of head.

Fig. 13.Clivinema villosa Reut. Cephalic aspect of head.

Fig.14. Monolocoris filicis(Linn.). Cephalic aspect of head.

Fig.15. Sixeonotus tenebrosus Dist. Cephalic aspect of head.

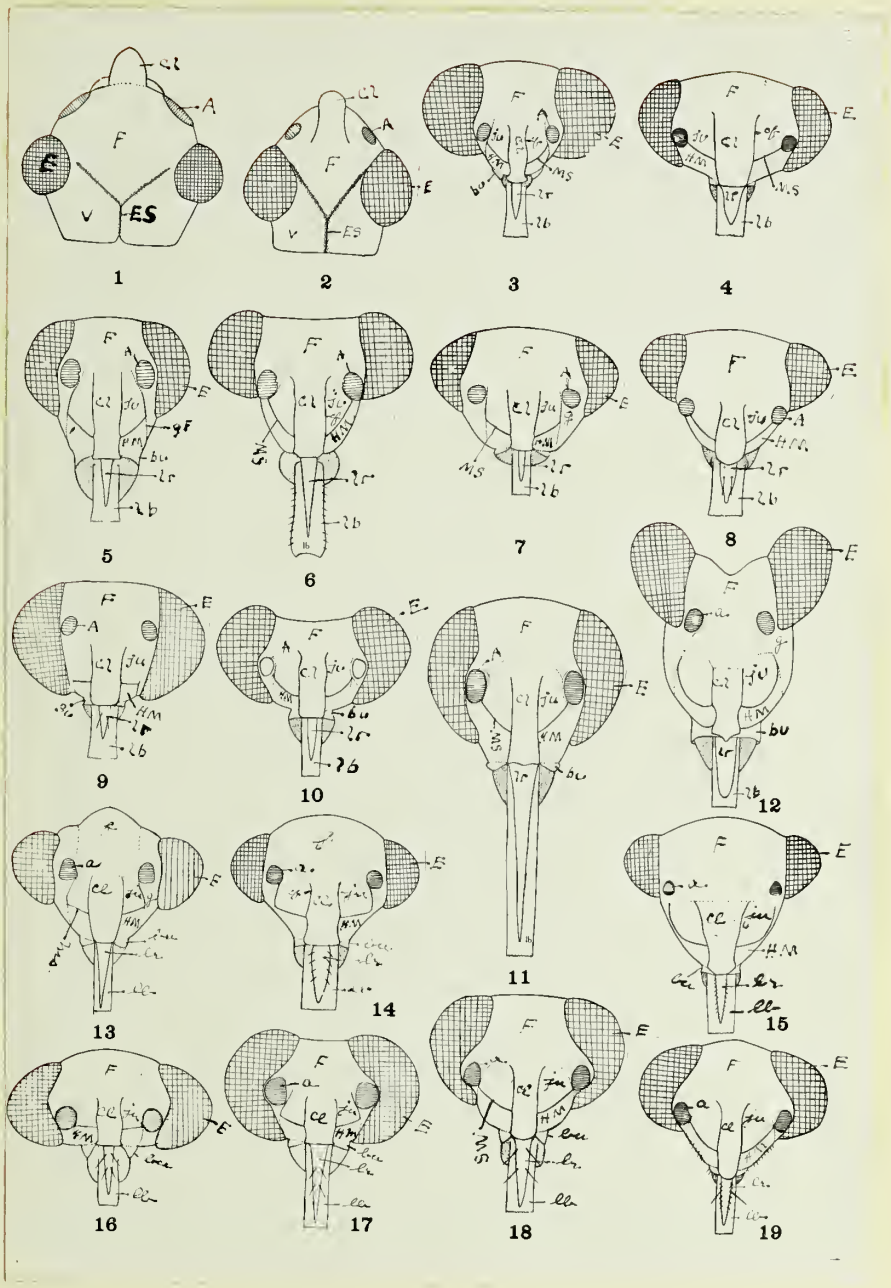
Fig. 16.Camptobrochis nebulosus(Uhl.). Cephalic aspect of head.

Fig.17. Cimatlan mundum(Uhl.). Cephalic aspect of head.

Fig.18. Lygus sp. Cephalic aspect of head.

Fig.19. Lygus pratensis(Linn.). Cephalic aspect of head.

Plate I.



Explanation of Plate II.

Fig.20. Poeciloscytus venaticus Uhl. Cephalic aspect of head.

Fig.21. Poecilocapsus lineatus(Fabr.). Cephalic aspect of head.

Fig.22. Garganus fusiformis(Say). Cephalic aspect of head.

Fig. 23.Adelphocoris rapidus(Say). Cephalic aspect of head.

Fig. 24.Neurocolpus nubilis(Say). Cephalic aspect of head.

Fig.25. Platytylellus sp. Cephalic aspect of head.

Fig.26. Trigonotylus ruficornis(Fall.). Cephalic aspect of head.

Fig.27. Miris dolobrata(Linn.). Cephalic aspect of head.

Fig. 28.Chlamydatus associatus(Uhl.). Lateral aspect of head.

Fig.29. Reuteroscopus ornatus(Reut.). Lateral aspect of head.

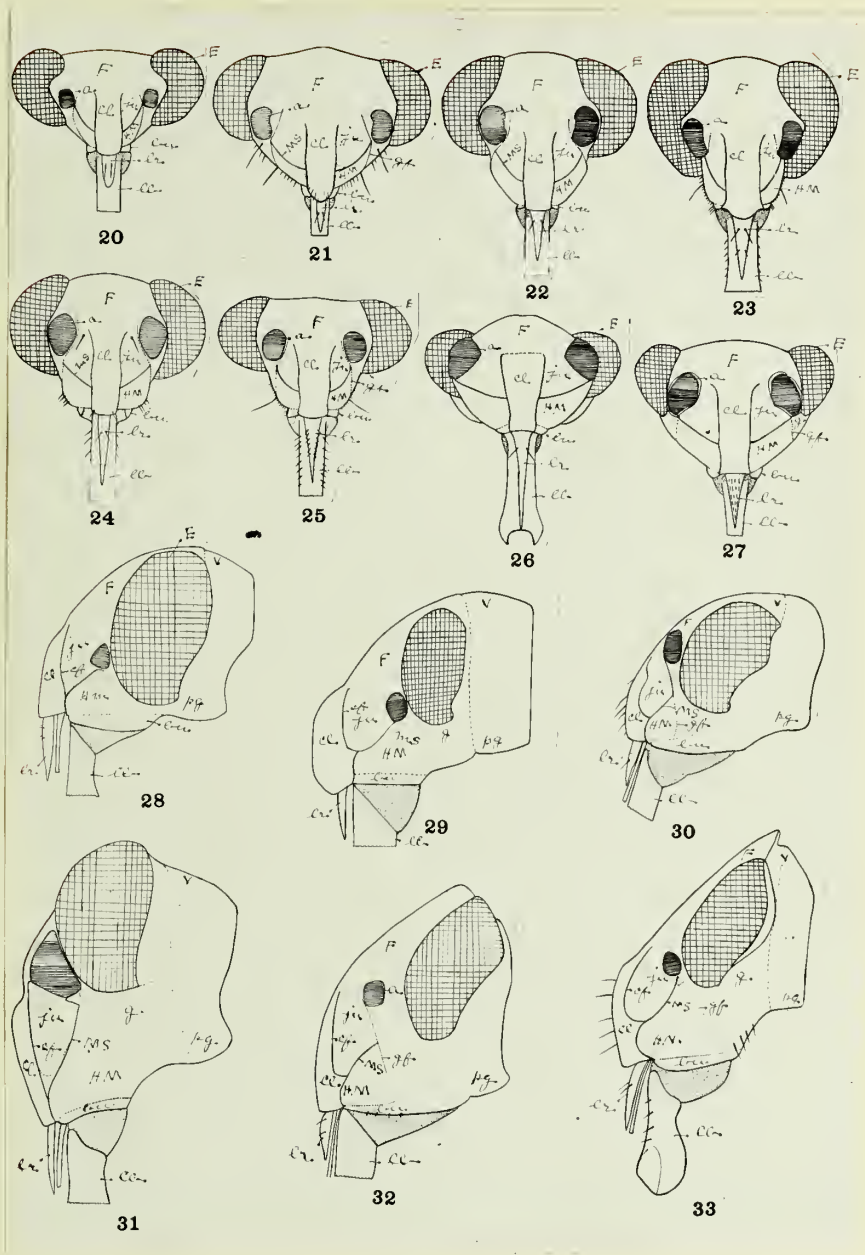
Fig.30. Pseudoxenetus scutellatus(Uhl.). Lateral aspect of head.

Fig.31. Lopidea media(Say). Lateral aspect of head.

Fig.32. Pilophorus schwarzi Reut. Lateral aspect of head.

Fig.33. Strongylocoris stygicus(Say). Lateral aspect of head.

Plate II.



Explanation of Plate III.

Fig.34. Hyaliodes vitripennis(Say) Lateral aspect of head.

Fig.35. Coquillettia amoenus(Uhl.). Lateral aspect of head.

Fig.36. Fulvius brunneus(Prov.). Lateral aspect of head.

Fig.37. Cylapus tenuicornis Say. Lateral aspect of head.

Fig.38. Clivinema villosa Reut. Lateral aspect of head.

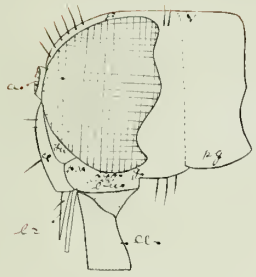
Fig.39. Monolocoris filicis(Linn.). Lateral aspect of head.

Fig.40. Sixeonotus tenebrosus Dist. Lateral aspect of head.

Fig.41. Camptobrochis nebulosus(Uhl.). Lateral aspect of head.

Fig.42. Cimatlan mundum(Uhl.) Lateral aspect of head.

Plate III.



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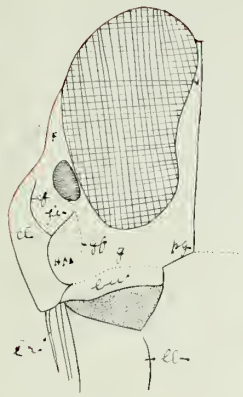

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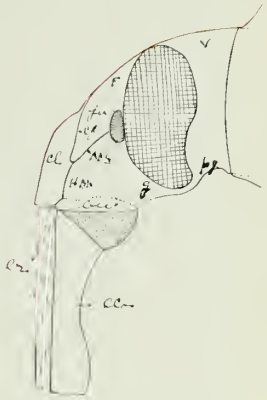

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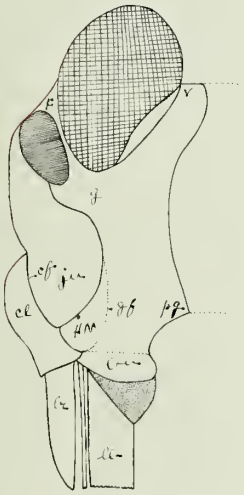

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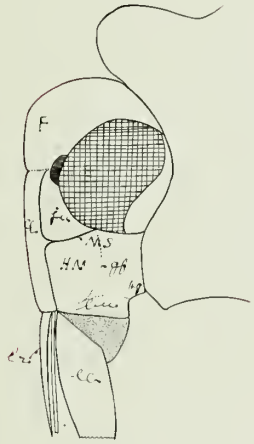

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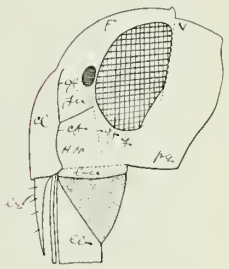

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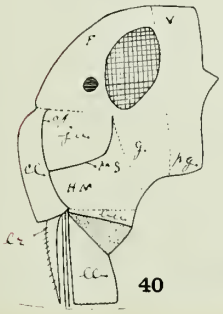

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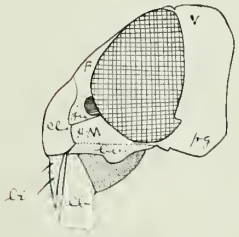

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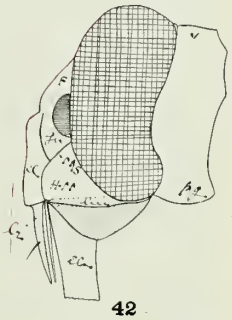

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Explanation of Plate IV.

Fig.43. Lygus pratensis(Linn.). Lateral aspect of head.

Fig.44. Lygus sp. Lateral aspect of head.

Fig.45. Poeciloscytus venaticus Uhl. Lateral aspect of head.

Fig.46. Poecilocapsus lineatus(Fabr.). Lateral aspect of head.

Fig.47. Garganus fusiformis(Say). Lateral aspect of head.

Fig.48. Adelphocoris rapidus(Say). Lateral aspect of head.

Fig.49. Neurocolpus nubilis(Say). Lateral aspect of head.

Fig.50. Platytylellus sp. Lateral aspect of head.

Fig.51. Trigonotylus ruficornis(Fall.). Lateral aspect of head.

Fig.52. Miris dolobrata(Linn.). Lateral aspect of head.

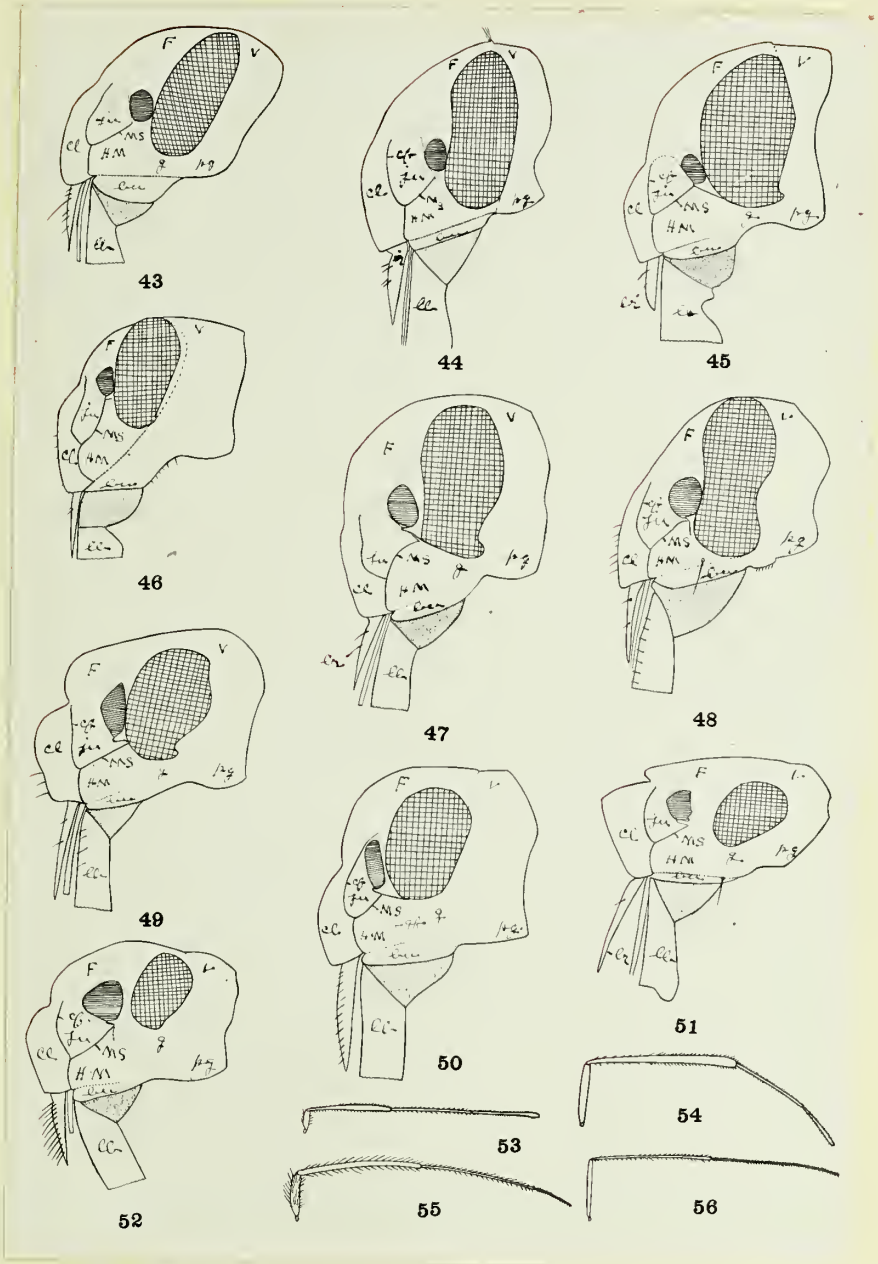
Fig.53. Chlamydatus associatus(Uhl.). Antenna.

Fig.54. Pseudoxenetus scutellatus(Uhl.). Antenna.

Fig.55. Lopidea media(Say). Antenna.

Fig.56. Hyaliodes vitripennis(Say). Antenna.

Plate IV.



Explanation of Plate V.

Fig.57. Cylapus tenuicornis Say. Antenna.

Fig.58. Monolocoris filicis(Linn.). Antenna.

Fig.59. Cimatlan mundum(Uhl.) Antenna.

Fig.60. Poeciloscytus venaticus Uhl. Antenna.

Fig.61. Platytylellus sp. Antenna.

Fig.62. Garganus fusiformis(Say). Antenna.

Fig.63. Adelphocoris rapidus(Say). Antenna.

Fig.64. Neurocolpus nubilis(Say). Antenna.

Fig.65. Miris dolobratus(Linn.). Antenna.

Fig.66. Trigonotylus ruficornis(Fall.). Antenna.

Fig.67. Adelphocoris rapidus(Say). a. Mandible.
b. Tip of mandible enlarged.

Fig.68. Adelphocoris rapidus(Say). a. Maxilla.
b. Tip of maxilla enlarged.

Fig.69. Chlamydatus associatus(Uhl.). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.70. Reuteroscopus ornatus(Reut.). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.71. Lopidea media(Say). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

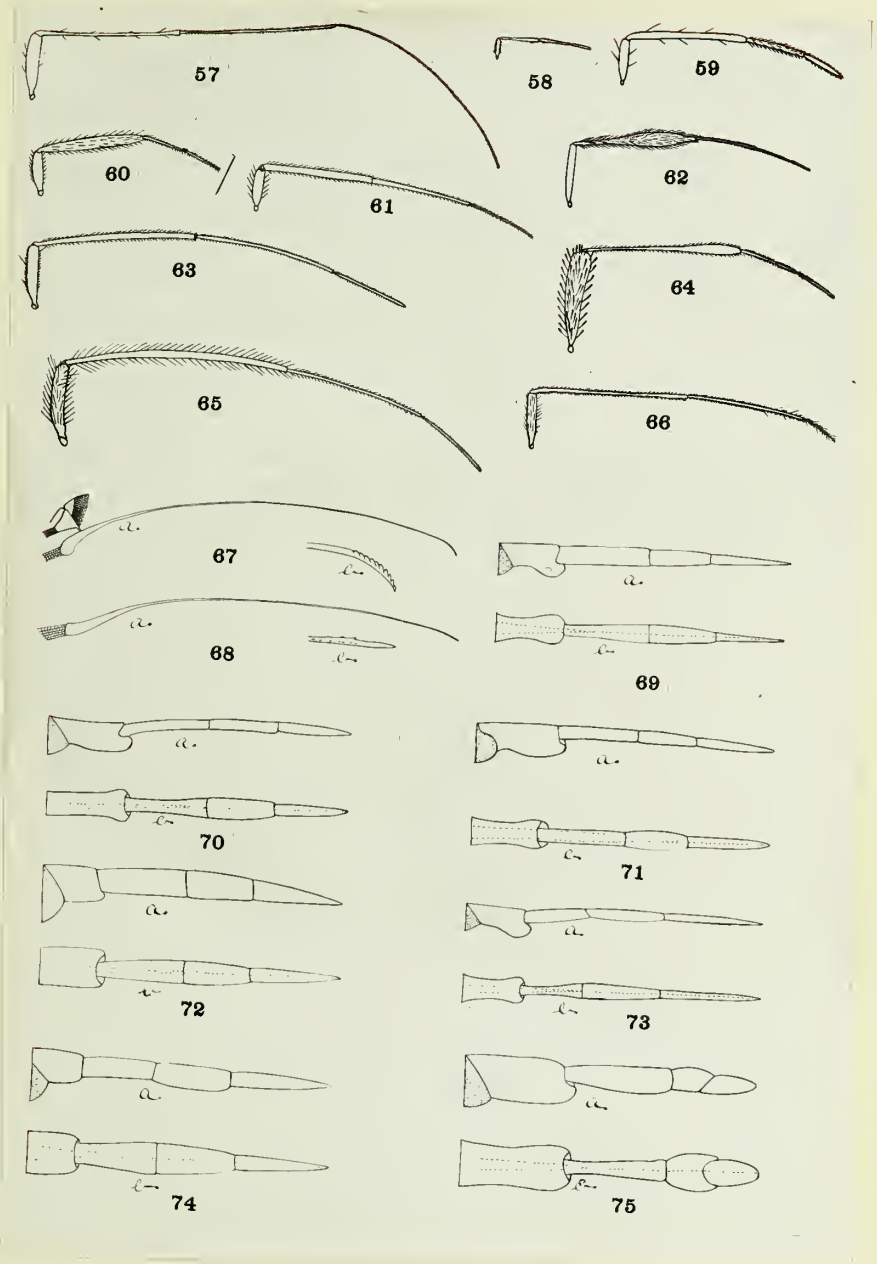
Fig. 72 Pilophorus schwarzi Reut. a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.73. Hyaliodes vitripennis(Say). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.74. Monolocoris filicis(Linn.). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.75. Sixeonotus tenebrosus Dist. a. Lateral aspect of Labium.
b. Dorsal aspect of Labium.

Plate V.



Explanation of Plate VI.

Fig.76. Poecilocapsus lineatus(Fabr.). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.77. Adelphocoris rapidus(Say). a.Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.78. Neurocolpus nubilis(Say). a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.79. Platytylellus sp. a. Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.80. Trigonotylus ruficornis(Fall.) a.Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.81. Miris dolobrata(Linn.). a.Lateral aspect of labium.
b. Dorsal aspect of labium.

Fig.82. Chlamydatus associatus(Uhl.). Dorsal aspect of prothorax.

Fig.83. Pseudoxenetus scutellatus(Uhl.).Dorsal aspect of prothorax.

Fig.84. Lopidea media(Say). Dorsal aspect of prothorax.

Fig.85. Pilophorus schwarzi Reut. Dorsal aspect of pronotum.

Fig.86. Strongylocoris stygicus(Say). Dorsal aspect of prothorax.

Fig.87. Hyaliodes vitripennis(Say). Dorsal aspect of prothorax.

Fig.88. Fulvius brunneus(Prov.). Dorsal aspect of prothorax.

Fig.89. Camptobrochis nebulosus(Uhl.). Dorsal aspect of prothorax.

Fig.90. Cimatlan mundum(Uhl.). Dorsal aspect of prothorax.

Fig.91. Lygus pratensis(Linn.). Dorsal aspect of prothorax.

Fig.92. Lygus sp. Dorsal aspect of prothorax.

Fig.93. Poeciloscytus venaticus Uhl. Dorsal aspect of prothorax.

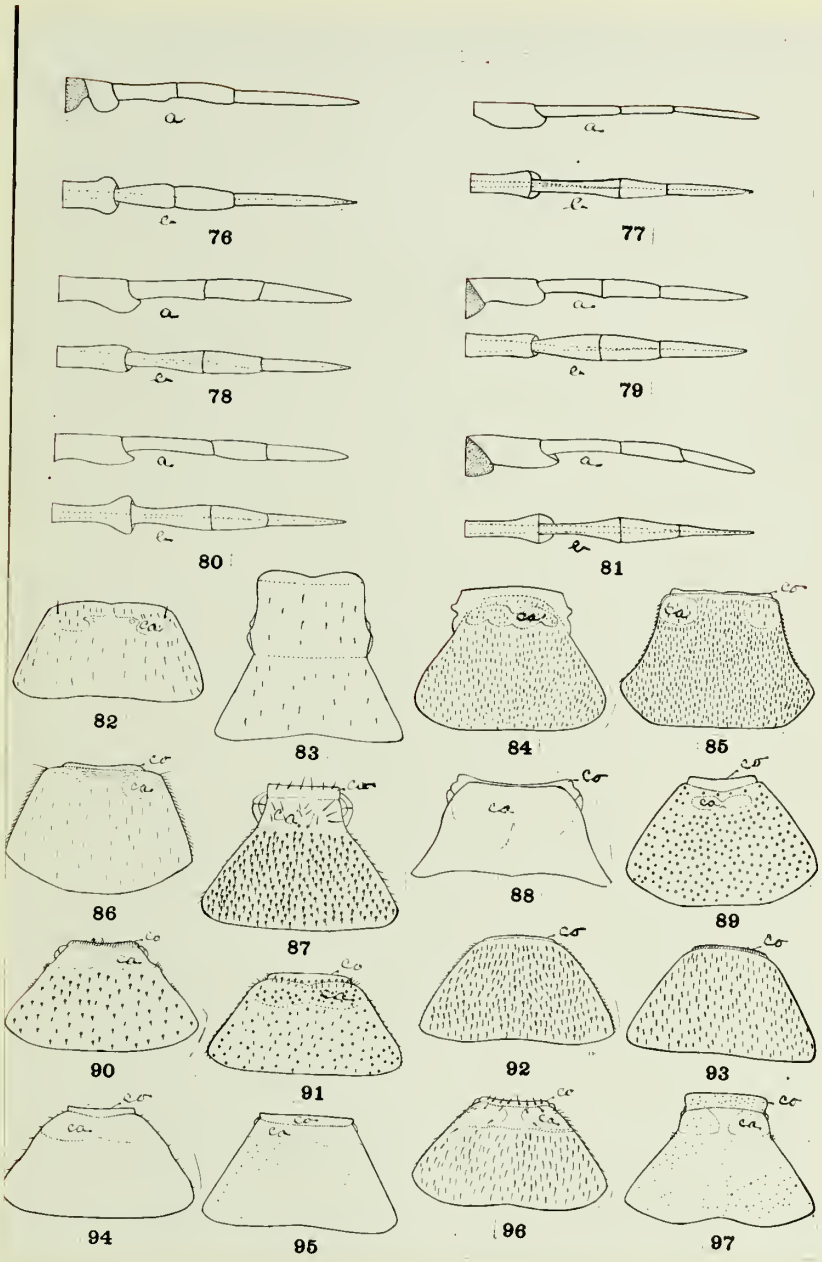
Fig.94. Poecilocapsus lineatus(Fabr.). Dorsal aspect of prothorax.

Fig.95. Garganus fusiformis(Say). Dorsal aspect of prothorax.

Fig.96. Adelphocoris rapidus(Say). Dorsal aspect of prothorax.

Fig.97. Neurocolpus nubilis(Say). Dorsal aspect of prothorax.

Plate VI.



Explanation of Plate VII.

Fig.98. Platytylellus sp. Dorsal aspect of pronotum.

Fig.99. Trigonotylus ruficornis(Fall.) Dorsal aspect of pronotum.

Fig.100. Miris dolobrata(Linn.) Dorsal aspect of pronotum.

Fig.101. Miris dolobrata(Linn.) Ventral aspect of pronotum.

Fig.102. Lopidea media(Say). Ventral aspect of pronotum.

Fig.103. Adelphocoris rapidus(Say). Ventral aspect of pronotum.

Fig.104. Strongylocoris stygicus(Say). Ventral aspect of pronotum.

Fig.105. Poecilocapsus lineatus(Fabr.).Ventral aspect of pronotum.

Fig. 106.Lygus pratensis(Linn.). Ventral aspect of pronotum.

Fig.107. Chlamydatus associatus(Uhl.). Ventral aspect of prothorax.

Fig.108. Trigonotylus ruficornis(Fall.)Ventral aspect of prothorax.

Fig.109. Hyaliodes vitripennis(Say). Ventral aspect of prothorax.

Fig.110. Camptobrochis nebulosis(Uhl.). Ventral aspect of prothorax

Fig.111. Lygus sp. Ventral aspect of prothorax.

Fig.112. Pilophorus schwarzi Reut. Ventral aspect of prothorax.

Fig.113.Cimatlan mundum(Uhl.). Ventral aspect of prothorax.

Fig.114. Pseudoxenetus scutellatus(Uhl.)Ventral aspect of prothorax

Fig.115. Neurocolpus nubilis(Say). Ventral aspect of prothorax.

Fig.116. Platytylellus sp. Ventral aspect of prothorax.

Fig.117. Poeciloscytus venaticusUhl. Ventral aspect of prothorax.

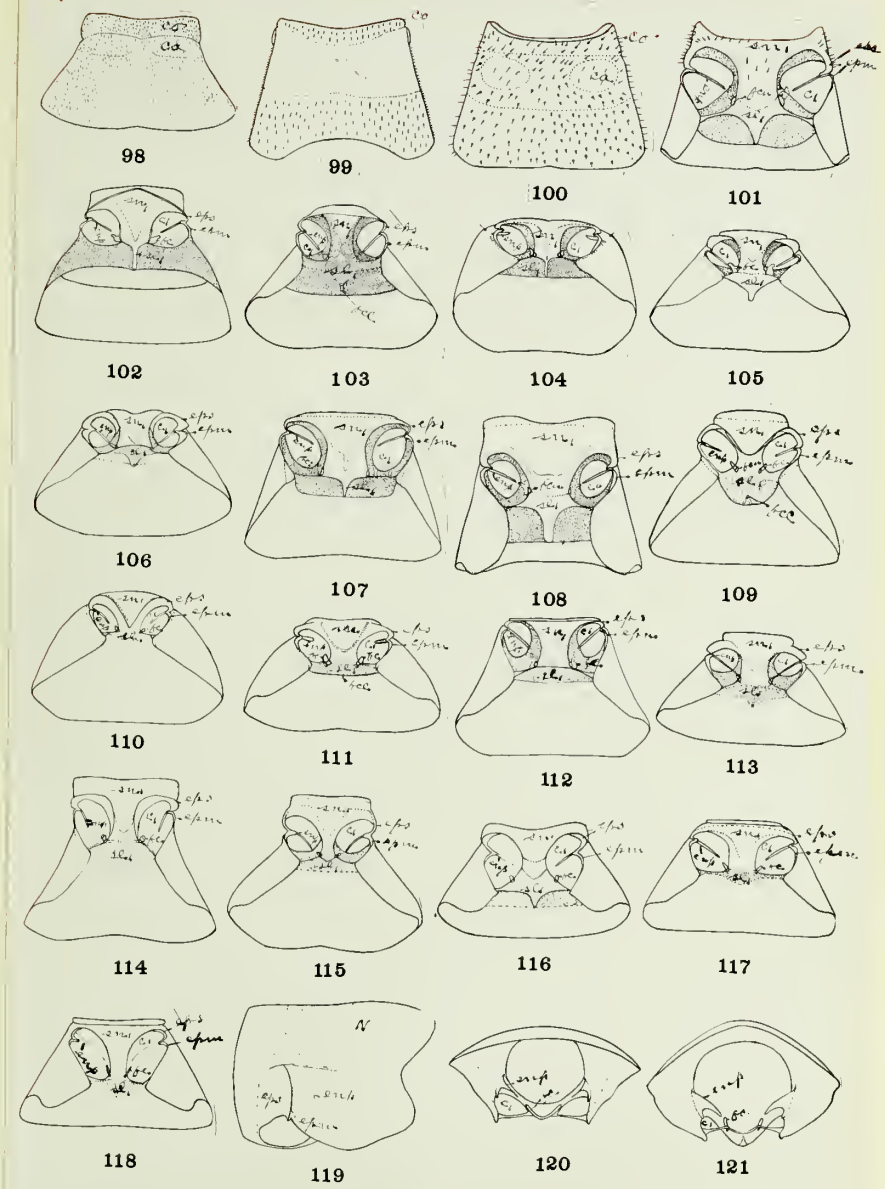
Fig.118. Garganus fusiformis(Say). Ventral aspect of prothorax.

Fig.119. Miris dolobrata(Linn.). Lateral aspect of prothorax.

Fig.120. Chlamydatus associatus(Uhl.).Caudal aspect of prothorax.

Fig.121. Pseudoxenetus scutellatus(Uhl.)Caudal aspect of prothorax.

Plate VII.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Explanation of Plate VIII.

Fig.122. Pilophorus schwarzi Reut. Caudal aspect of prothorax.

Fig.123. Strongylocoris stygicus(Say). Caudal aspect of prothorax.

Fig.124. Hyaliodes vitripennis(Say). Caudal aspect of prothorax.

Fig.125. Camptobrochis nebulosis(Uhl.). Caudal aspect of prothorax.

Fig.126. Cimatlan mundum(Uhl.). Caudal aspect of prothorax.

Fig. 127. Lygus sp. Caudal aspect of prothorax.

Fig.128. Lygus pratensis(Linn.) Caudal aspect of prothorax.

Fig.129. Poeciloscytus venaticus Uhl. Caudal aspect of prothorax.

Fig.130. Poecilocapsus lineatus(Fabr.) Caudal aspect of prothorax.

Fig.131. Garganus fusiformis(Say). Caudal aspect of prothorax.

Fig. 132. Adelphocoris rapidus (Say). Caudal aspect of prothorax.

Fig.133. Neurocolpus nubilis(Say). Caudal aspect of prothorax.

Fig. 134. Trigonotylus ruficornis(Fall.)Caudal aspect of prothorax.

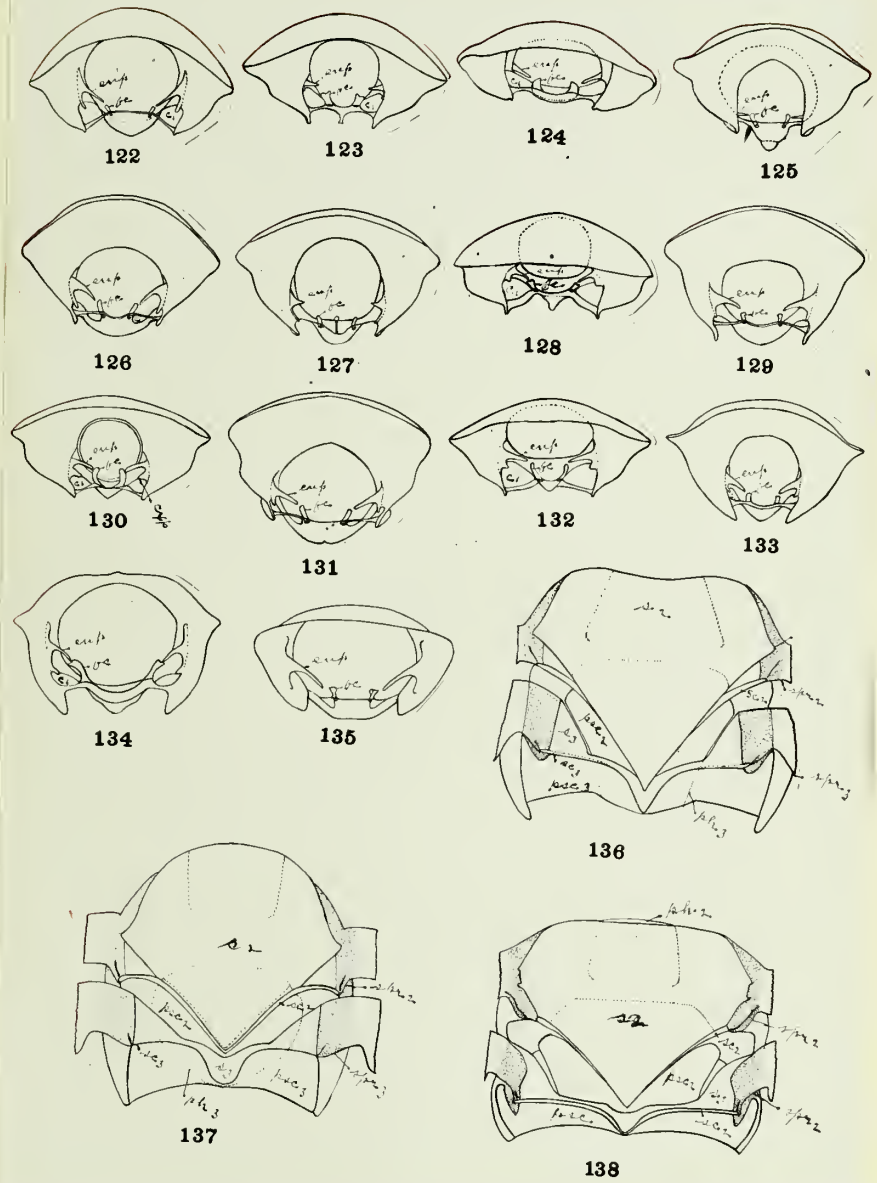
Fig.135. Miris dolobrata(Linn.). Caudal aspect of prothorax.

Fig.136. Chlamydatus associatus(Uhl.) Dorsal aspect of mesothorax and metathorax.

Fig.137. Pseudoxenetus scutellaris(Uhl.) Dorsal aspect of mesothorax and metathorax.

Fig.138. Lopidea media(Say). Dorsal aspect of mesothorax and metathorax.

Plate VIII.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Explanation of Plate IX.

Fig.139. Pilophorus schwarzi Reut. Dorsal aspect of mesothorax and metathorax.

Fig.140. Strongylocoris stygicus(Say). Dorsal aspect of mesothorax and metathorax.

Fig.141. Hyaliodes vitripennis(Say). Dorsal aspect of mesothorax and metathorax.

Fig.142. Camptobrochi nebulosus(Uhl.). Dorsal aspect of mesothorax and metathorax.

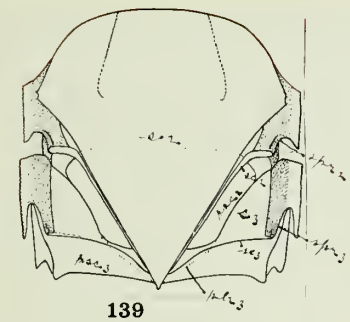
Fig.143. Cimatlan mundum(Uhl.). Dorsal aspect of mesothorax and metathorax.

Fig.144. Lygus pratensis(Linn.). Dorsal aspect of mesothorax and metathorax.

Fig.145. Poecilocapsus lineatus(Fabr.). Dorsal aspect of mesothorax and metathorax.

Fig.146. Adelphocoris rapidus(Say). Dorsal aspect of mesothorax and metathorax.

Plate IX.



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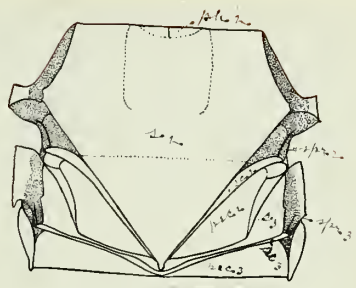

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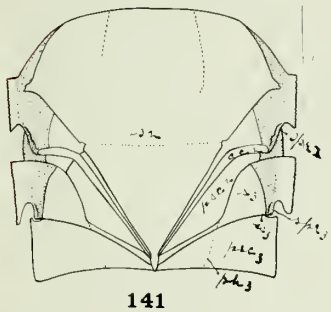

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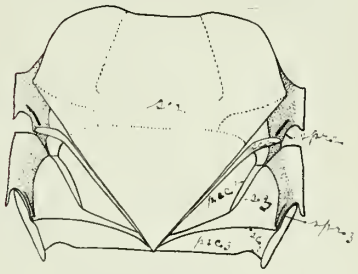

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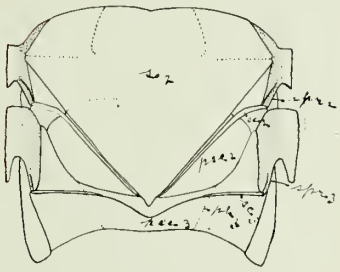

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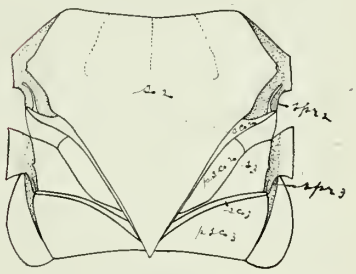

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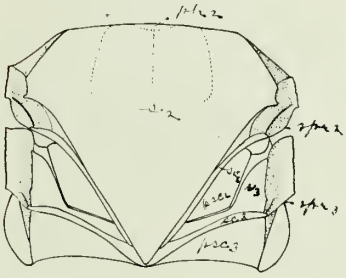

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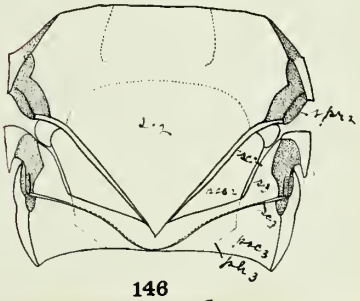

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Explanation of Plate X.

Fig.147. Trigonotylus ruficornis(Fall.). Dorsal aspect of mesothorax and metathorax.

Fig.148. Miris dolobrata(Linn.). Dorsal aspect of mesothorax and metathorax.

Fig.149. Chlamydatus associatus(Uhl.). Ventral aspect of Mesothorax and metathorax.

Fig.150. Lopidea media(Say). Ventral aspect of mesothorax and metathorax.

Fig.151. Adelphocoris rapidus (Say). Ventral aspect of mesothorax and metathorax.

Fig.152. Miris dolobrata(Linn.). Ventral aspect of mesothorax and Metathorax.

Fig.153. Lopidea media(Say). Lateral aspect of mesothorax and metathorax.

Fig.154. Adelphocoris rapidus(Say). Lateral aspect of mesothorax and metathorax.

Fig.155. Miris dolobrata(Linn,). Lateral aspect of mesothorax and metathorax.

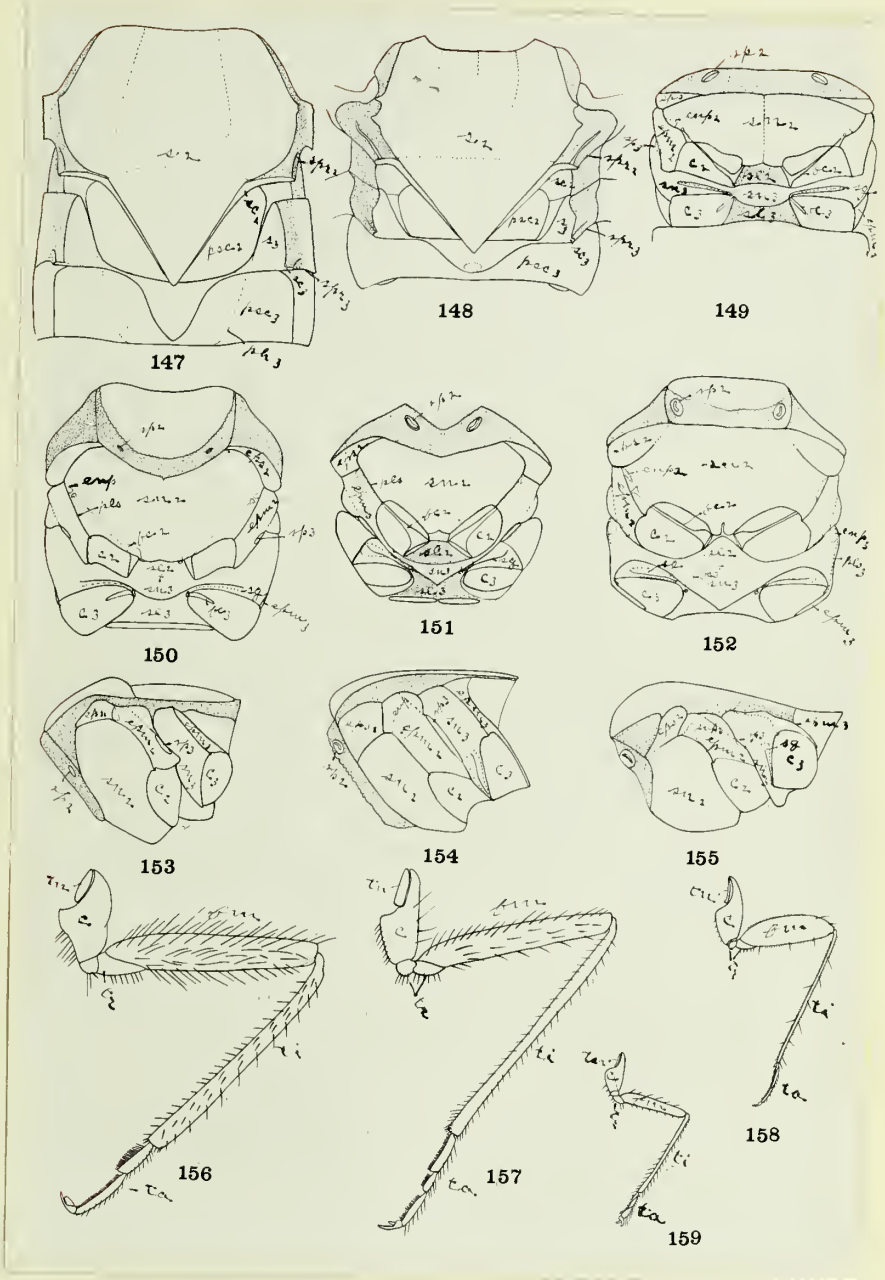
Fig.156. Miris dolobrata(Linn.). Cephalic aspect of metaleg of nymph.

Fig.157.Miris dolobrata(Linn.). Cephalic aspect of metaleg.

Fig.158. Chlamydatus associatus(Uhl.). Cephalic aspect of metaleg.

Fig.159. Monolocoris filicis(Linn.). Cephalic aspect of metaleg.

Plate X.



Explanation of Plate XI.

Fig.160. Adelphocoris rapidus(Say). Cephalic aspect of metaleg.

Fig.161. Lopidea media(Say). Cephalic aspect of metaleg.

Fig.162. Lopidea media(Say). Articularis.

Fig.163. Poecilocapsus lineatus(Fabr.). Articularis,

Fig.164. Cimatlan mundum(Uhl.). Articularis.

Fig.165. Chlamydatus associatus(Uhl.). Articularis.

Fig.166. Reuteroscopus ornatus(Reut.). Articularis.

Fig.167. Miris dolobrata(Linn.). Dorsal aspect of abdomen of female

Fig.168. Miris dolobrata(Linn.).Ventral aspect of abdomen of female

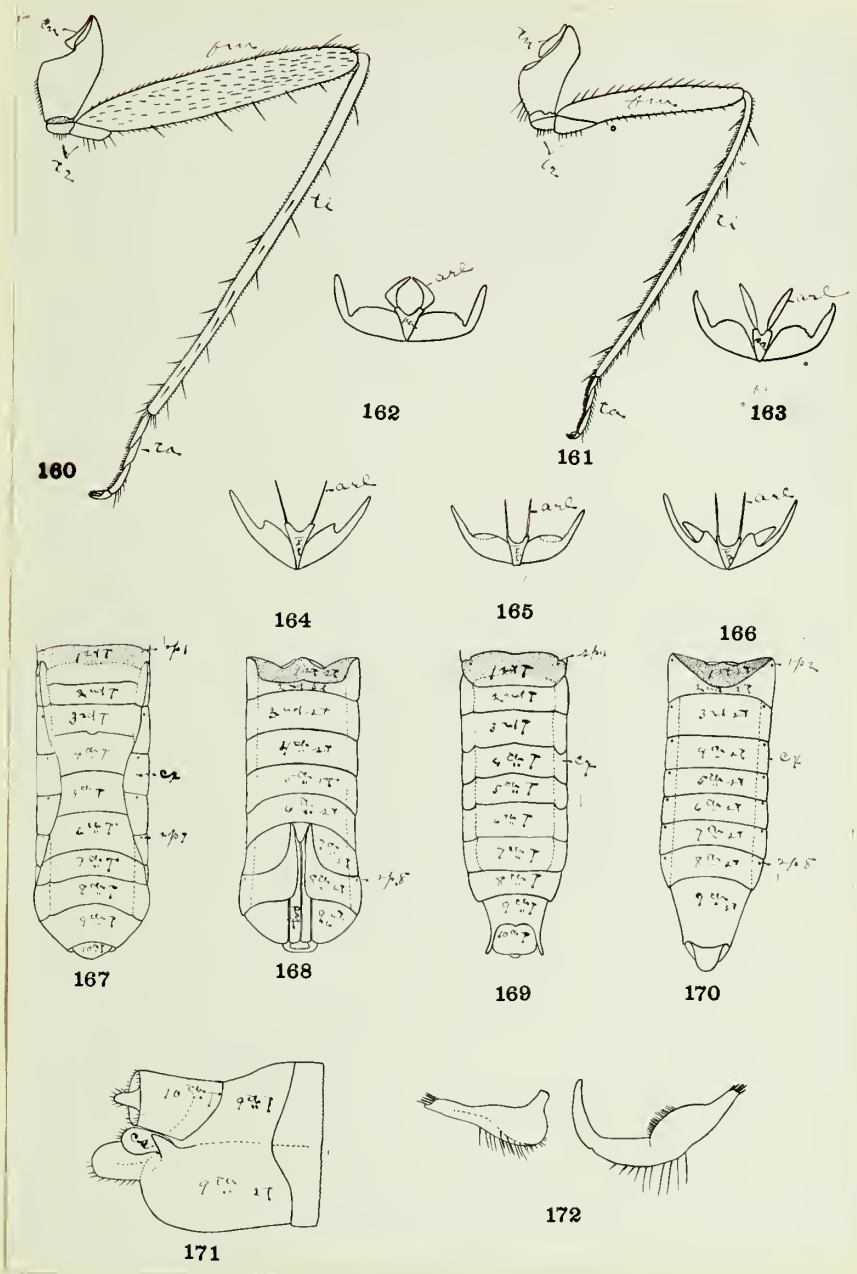
Fig.169. Mirisdolobrata(Linn.). Dorsal aspect of abdomen of male.

Fig.170. Miris dolobrata(Linn.).Ventral aspect of abdomen of male.

Fog.171. Miris dolobrata(Linn.).Lateral aspect of abdomen of male.

Fig.172. Miris dolobrata(Linn.). Claspers of male.

Plate XI.



Explanation of Plate XII.

Fig.173. Chlamydatus associatus(Uhl.) Mesowing.

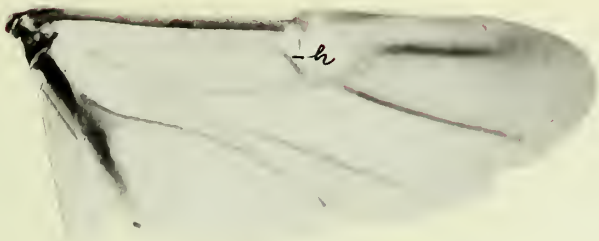
Fig.174. Chlamydatus associatus(Uhl.). Metawing.

Fig.175. Reuteroscopus ornatus(Reut.). Mesowing.

Fig.176. Reuteroscopus ornatus(Reut.). Metawing.

Plate XII.

173



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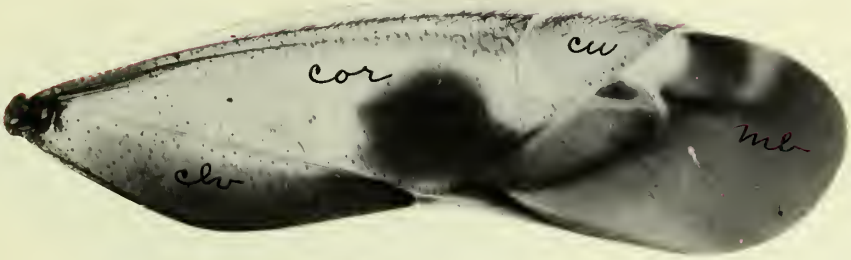

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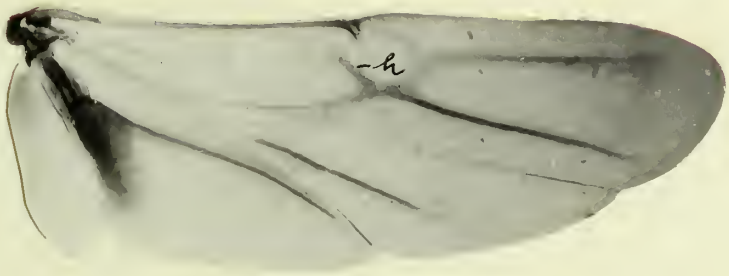


176

Explanation of Plate XIII.

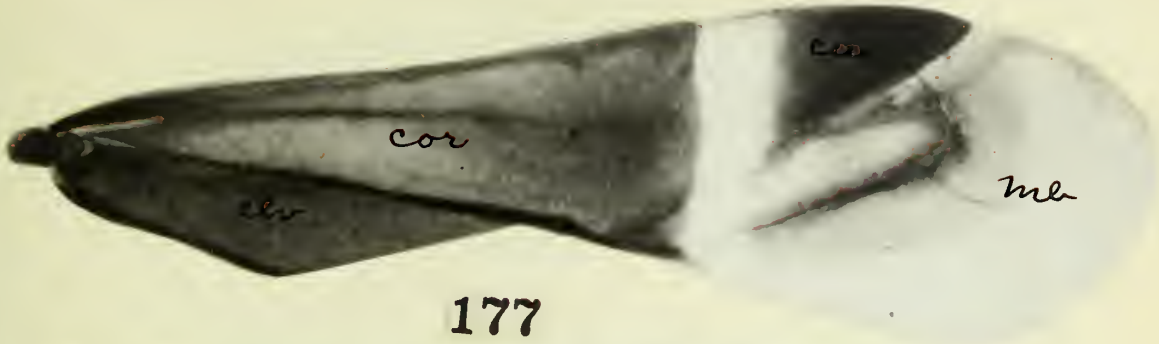
Fig.177. Pseudoxenetus scutellatus(Uhl.). Mesowing.

Fig.178. Pseudoxenetus scutellatus(Uhl.). Metawing.

Fig.179. Lopidea media(Say). Mesowing.

Fig.180. Lopidea media(Say). Metawing.

Plate XIII.



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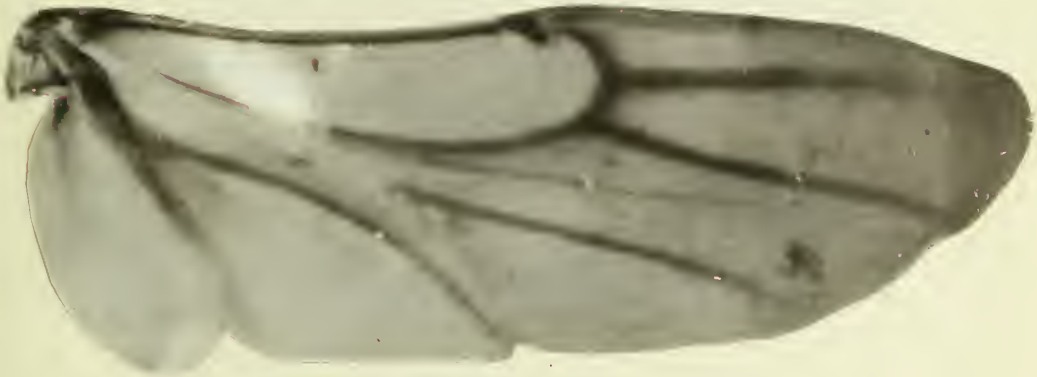

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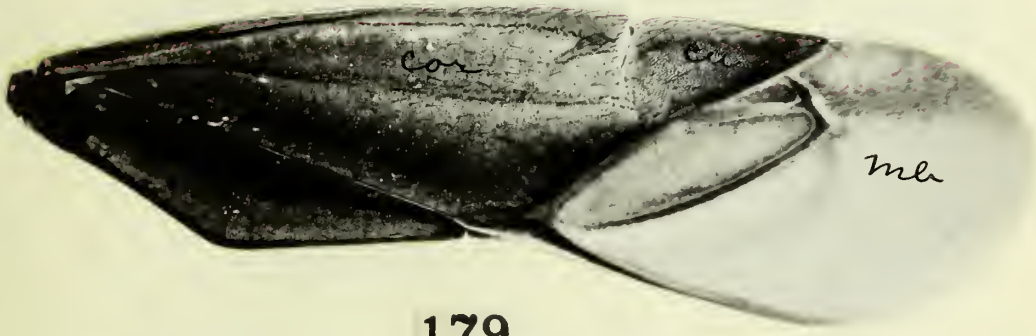

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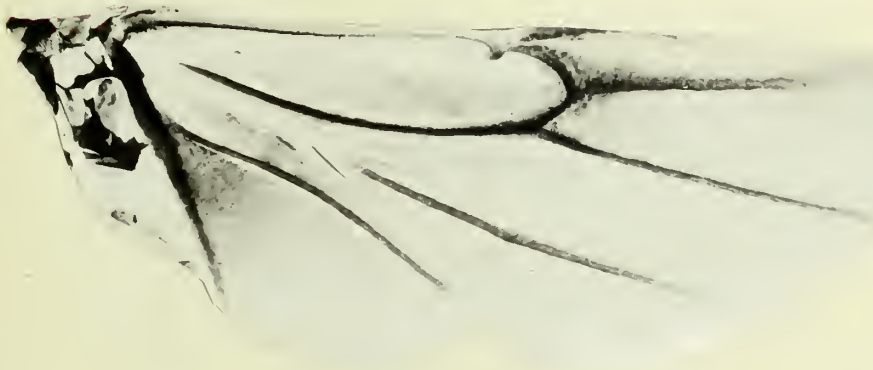


180

Explanation of Plate XIV.

Fig.181. Pilophorus schwarzi Reut. Mesowing.

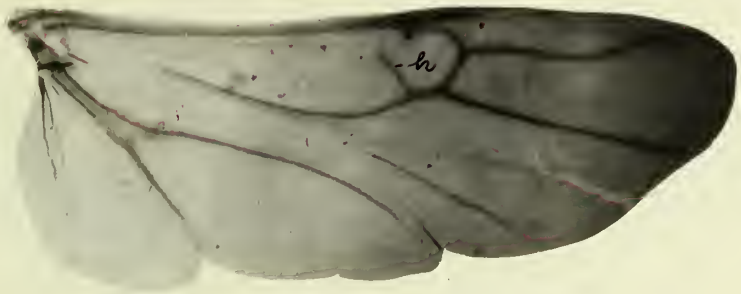
Fig.182. Pilophorus schwarzi Reut. Metawing.

Fig. 183.Strongylocoris stygicus(Say). Mesowing.

Fig.184. Strongylocoris stygicus(Say). Metawing.

Plate XIV.

181



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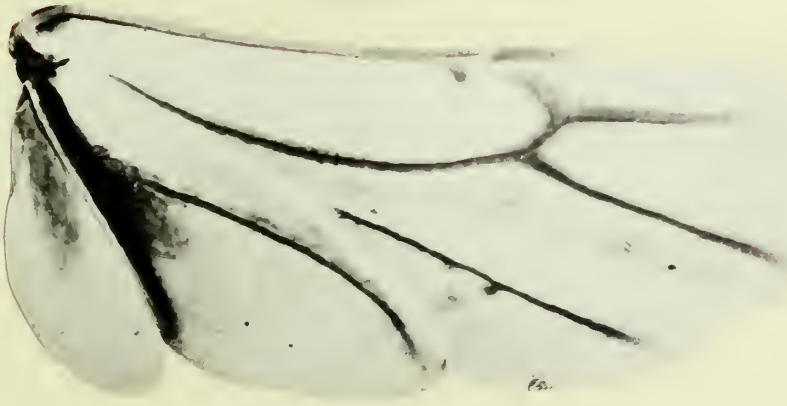

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Explanation of Plate XV.

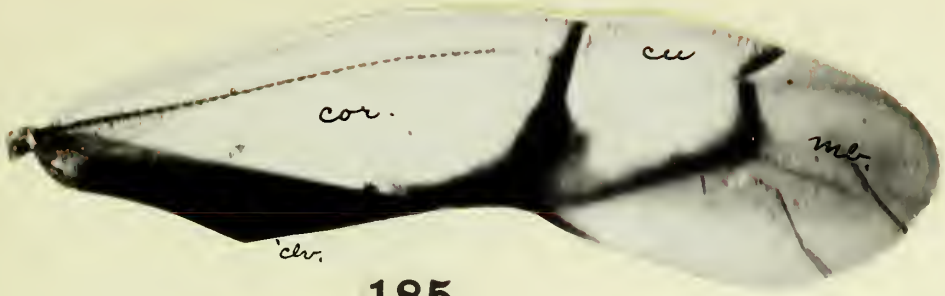
Fig.185. Hyaliodes vitripennis(Say). Mesowing.

Fig.186. Hyaliodes vitripennis(Say). Metawing.

Fig.187. Monolocoris filicis(Linn.). Mesowing.

Fig.188. Monolocoris filicis(Linn.). Metawing.

Plate XV.



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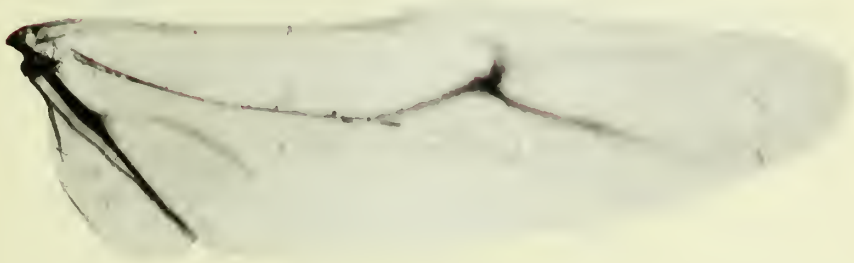

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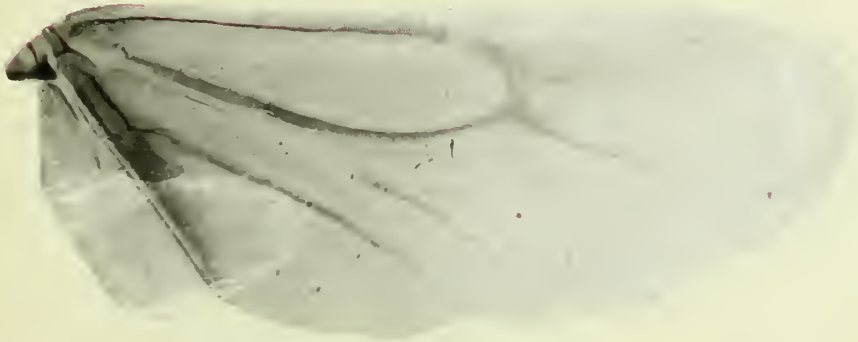


188

Explanation of Plate XVI.

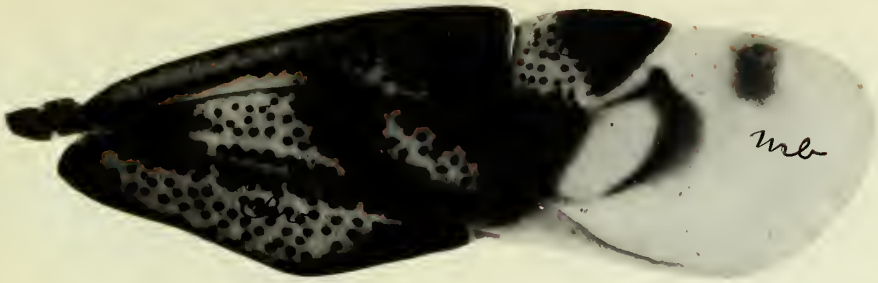
Fig.189. Camptobrochis nebulosus(Uhl.). Mesowing.

Fig.190. Camptobrochis nebulosus(Uhl.). Metawing.

Fig.191. Lygus sp. Mesowing.

Fig.192. Lygus sp. Metawing.

Plate XVI.



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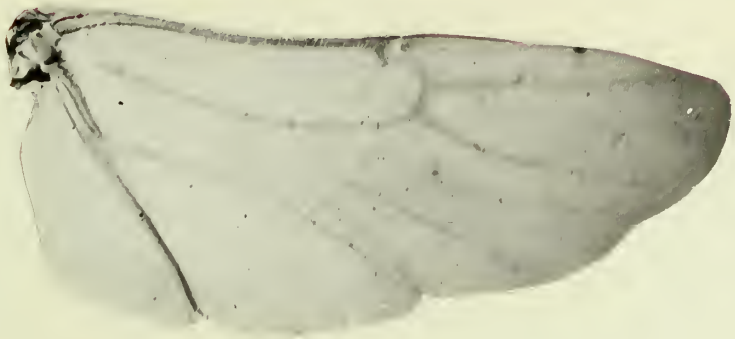

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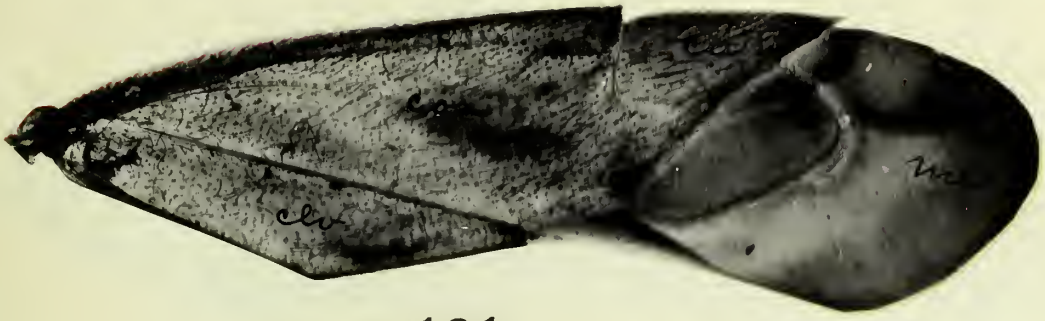

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Explanation of Plate XVII.

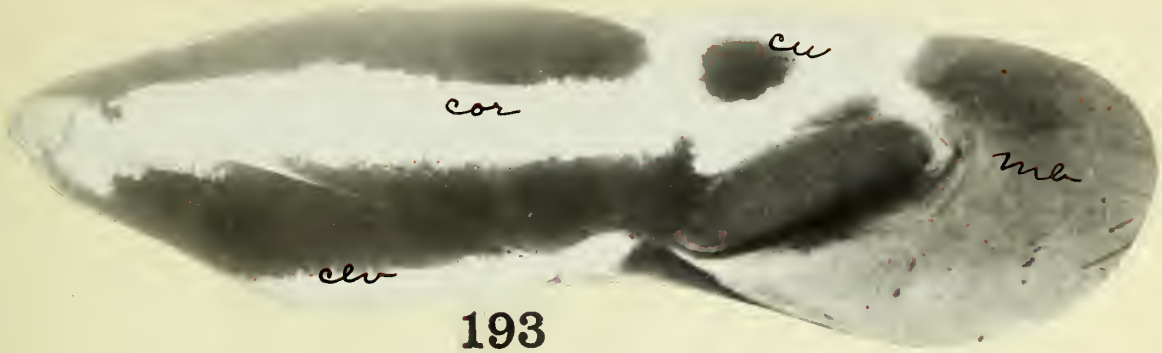
Fig. 193. Poecilocapsus lineatus (Fabr.). Mesowing.

Fig. 194. Poecilocapsus lineatus (Fabr.). Metawing.

Fig. 195. Garganus fusiformis (Say). Mesowing.

Fig. 196. Garganus fusiformis (Say). Metawing.

Plate XVII.



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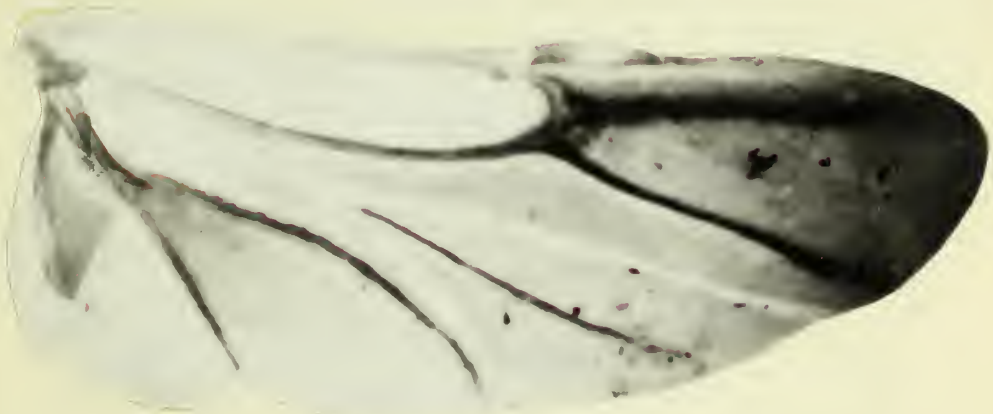

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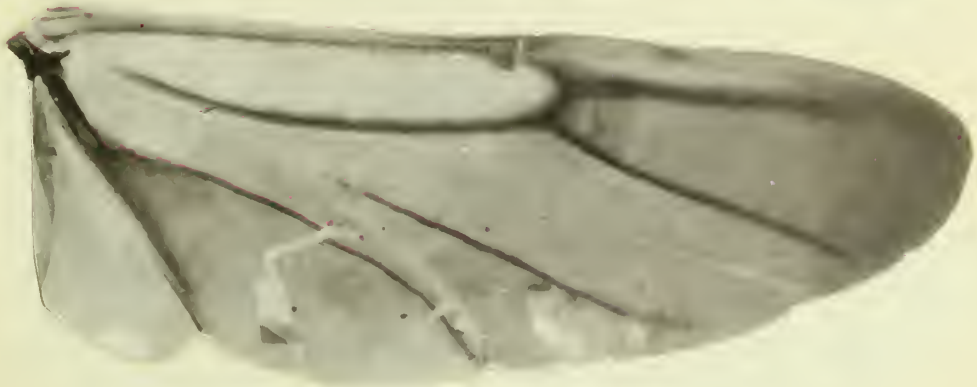

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Explanation of Plate XVIII.

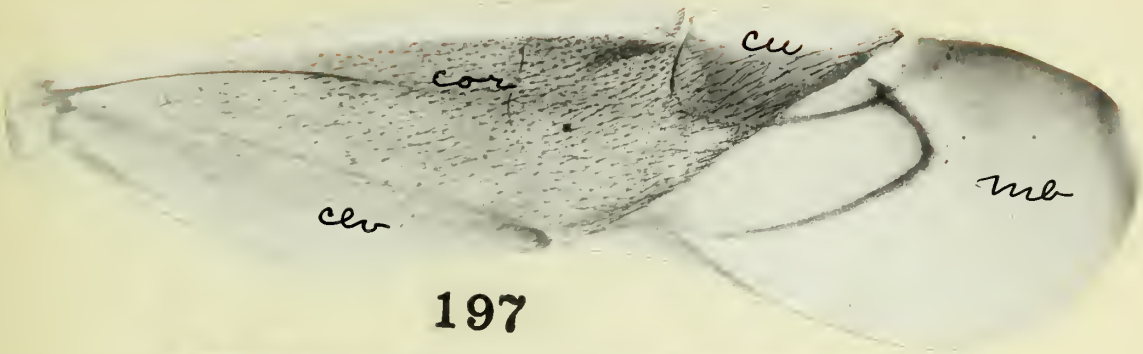
Fig.197. Adelphocoris rapidus(Say). Mesowing.

Fig.198. Adelphocoris rapidus(Say). Metawing.

Fig.199. Neurocolpus nubilis(Say). Mesowing.

Fig.200. Neurocolpus nubilis(Say). Metawing.

Plate XVIII.



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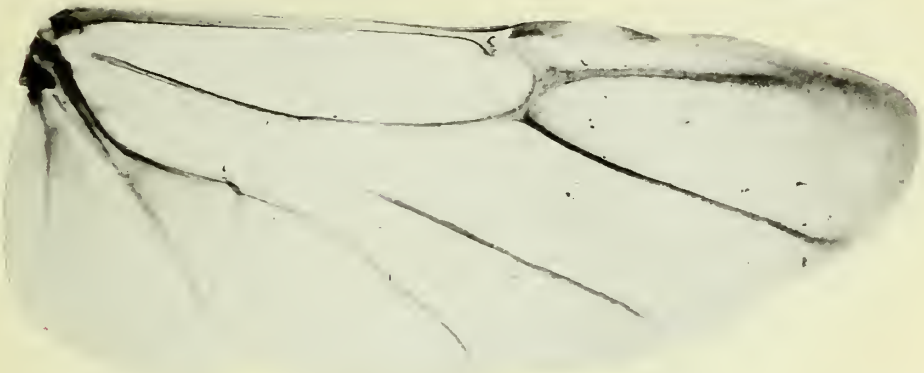

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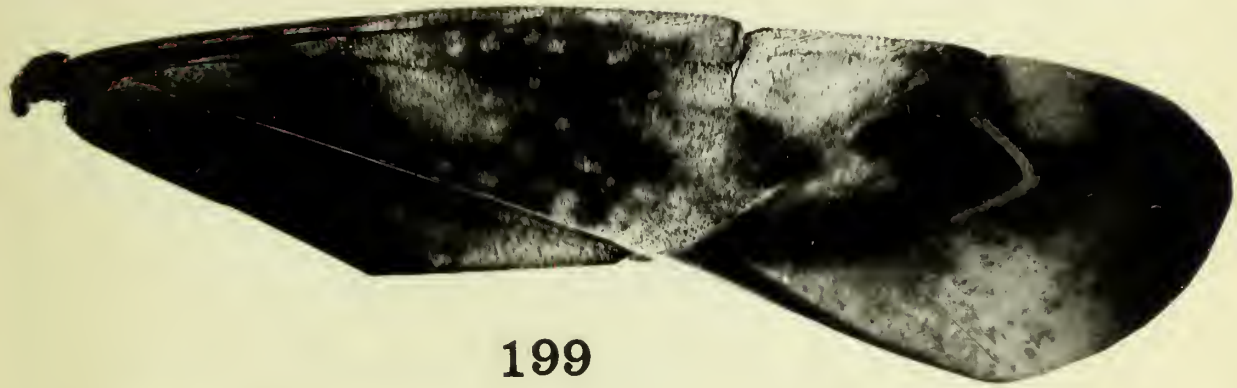

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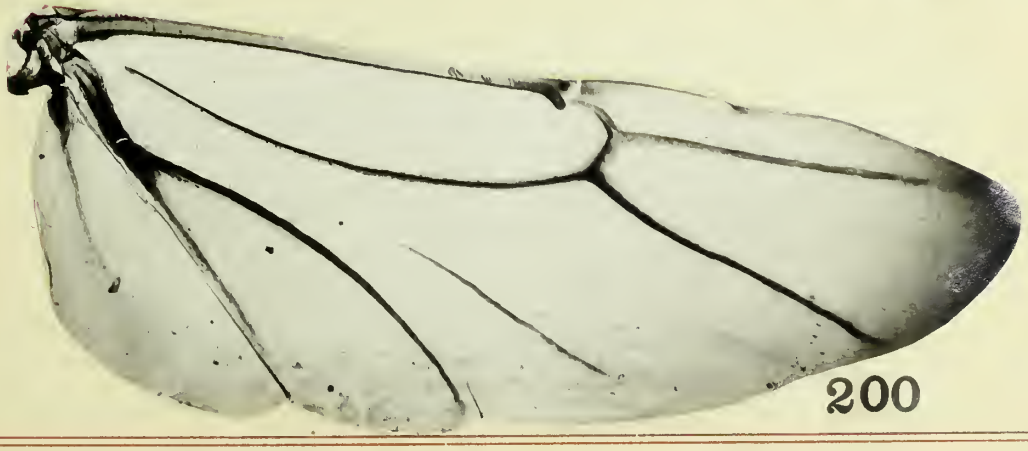

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Explanation of Plate XIX.

Fig.201. Platytylellus sp. Mesowing.

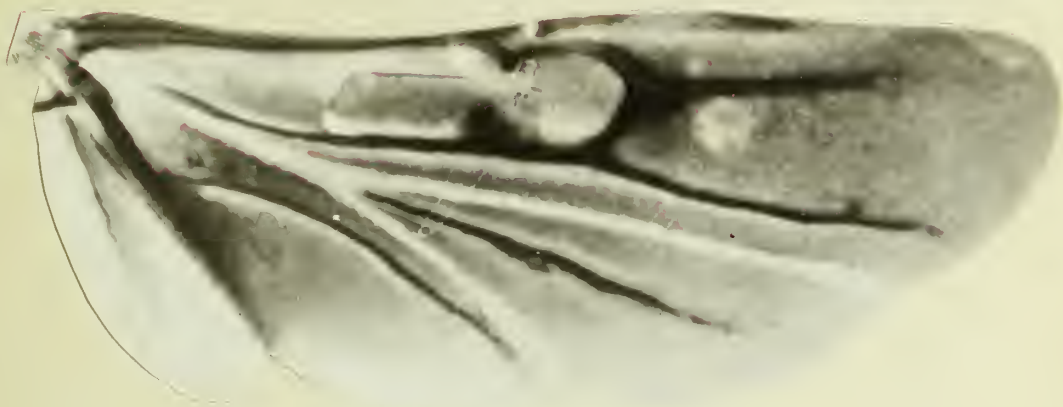
Fig.202. Platytylellus sp. Metawing.

Fig.203. Miris dolobrata(Linn.). Mesowing.

Fig.204. Miris dolobrata(Linn.). Metawing.

Plate XIX.

201



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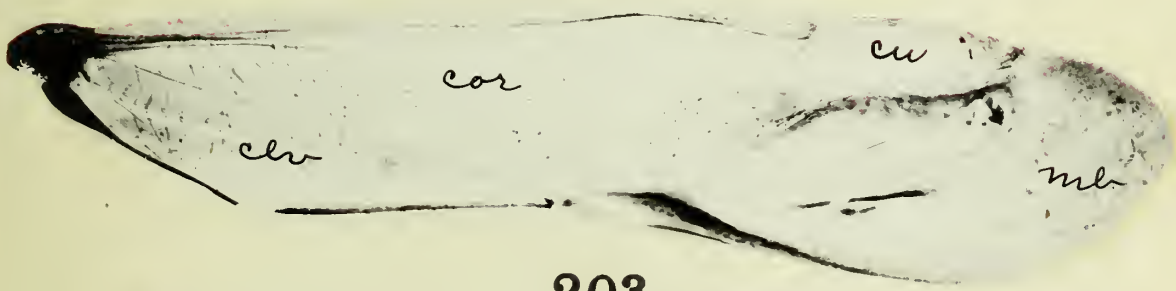

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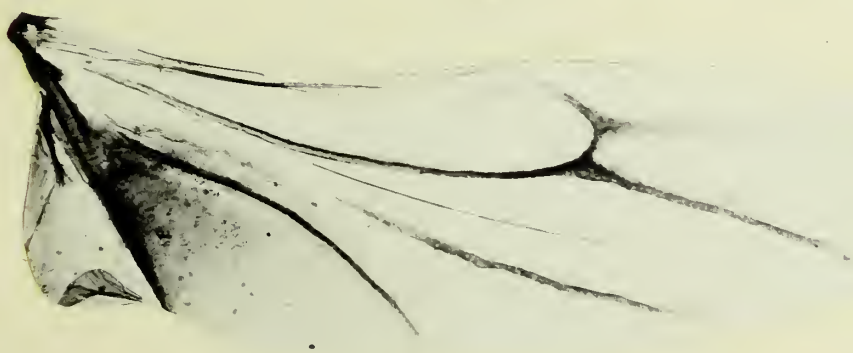

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